United States Court of Appeals

for the

District of Columbia Circuit

TRANSCRIPT OF RECORD

JOINT APPENDIX

In The

United States Court of Appeals

District of Columbia

United States Court of Appeals
District of Columbia Circuit
FILED APR 10 1951
Joseph W. Stewart
CLERK

457

No. 10,905

FLORENCE M. FORD,
ANNE E. HALL, Executrix of the Estate of
William P. Hall, Deceased, and
JOSEPH BANCROFT & SONS CO.,

Appellants

v.

JOHN A. MARZALL, Commissioner of Patents,

Appellee

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IN THE

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DISTRICT OF COLUMBIA

No. 10,905

FLORENCE M. FORD,
ANNE E. HALL, Executrix of the Estate of
William P. Hall, Deceased, and
JOSEPH BANCROFT & SONS CO.,
Appellants

v.

JOHN A. MARZALL, Commissioner of Patents,
Appellee

JOINT APPENDIX

99 Filed Dec. 31, 1948. Harry M. Hull, Clerk

IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

5217-'48

Complaint for Issuance of Patent Under R. S. 4915

Florence M. Ford
1420 Hamilton Street
Wilmington, Delaware
William P. Hall
1310 West Tenth Street
Wilmington, Delaware

and

Joseph Bancroft & Sons Co.
Rockford, Wilmington 99, Delaware

Plaintiffs

vs.

Lawrence C. Kingsland

Defendant

COMPLAINT

The plaintiffs herein for their complaint allege:

I

This is an action under U. S. Code, Title 35, Section 63, Revised Statutes Section 4915.

II

Plaintiff, Florence M. Ford, is a citizen of the United States residing at 1420 Hamilton Street, in the City of Wilmington, County of Newcastle, State of Delaware.

III

Plaintiff, William P. Hall, is a citizen of the United States
residing at 1310 West Tenth Street, in the City of
100 Wilmington, County of Newcastle, State of Delaware.

IV

Plaintiff, Joseph Bancroft & Sons Co., is a corporation duly organized and existing under the laws of the State of Delaware, having its principal place of business at Rockford, Wilmington, Delaware.

V

Defendant, Lawrence C. Kingsland, is the Commissioner of Patents of the United States, whose legal residence is in the District of Columbia, and who is sued as Commissioner of Patents of the United States.

VI

On December 7, 1944 plaintiffs, Florence M. Ford and William P. Hall, filed an application for a patent in the United States Patent Office, said application being entitled "Method of Producing Permanent Mechanical Finishes on Fibrous Materials", and said application was given Serial No. 567,118.

VII

By an instrument in writing dated December 4, 1944 and recorded in the United States Patent Office on December 7, 1944, in Liber N-201, page 536, 537 of the Transfers of Patents, plaintiffs, Florence M. Ford and William P. Hall, duly assigned to plaintiff, Joseph Bancroft & Sons Co., the entire right, title and interest in and to said invention and application.

101

VIII

Said application was filed in accordance with the laws of the United States and Rules of Practice of the United States Patent Office, and has been duly prosecuted in accordance with said laws and rules.

IX

On August 26, 1946 the Primary Examiner in said United States Patent Office finally rejected said application and refused to allow any claims thereof, and particularly the said claims of the said application as follows:

> 22. The process of imparting durable lustrous mechanical effects to cellulose and regenerated cellulose fibers and fabric, which comprises sizing the material with a water solution containing a polysaccharide carbohydrate and an aldehyde selected from the group consisting of formaldehyde, paraformaldehyde, glyoxal and acetaldol, drying the material to dampness, imparting a lustrous mechanical finish to the material by a pressure mechanical finishing machine, and curing the treated material by heating the material to from substantially 280° F. to substantially 400° F.
>
> 23. The process of Claim 22 in which the mechanical finish is imparted prior to the curing.
>
> 24. The process of Claim 22 in which the curing and the mechanical finishing are accomplished substantially simultaneously.
>
> 25. The process of Claim 22 in which an excess of aldehyde over the amount required to react with the carbohydrate is employed.
>
> 26. The process of Claim 22 in which the carbohydrate and aldehyde are preliminarily reacted in the presence of heat before the sizing operation to a temperature of from substantially 190° F. to just short of 212° F.

27. The process of Claim 22 in which the curing is accomplished at approximately 350° F.

102 28. The process of Claim 22 in which a catalyst is employed and the proportion of chemicals adjusted to give to the cured material a pH of from substantially 4 to substantially 5.

29. The process of Claim 22 in which the aldehyde is formaldehyde.

30. The process of Claim 22 in which the aldehyde is formaldehyde and in which the catalyst ammonium thiocyanate is employed.

31. The process of Claim 22 in which the material is dryed to dampness and in which the mechanical finish is imparted by friction glazing.

X

Within six months after said final rejection and on or about February 21, 1947, applicants appealed from the decision of the Primary Examiner to the Board of Appeals of said United States Patent Office, which said Board of Appeals in a decision dated July 8, 1948 affirmed the action of the Primary Examiner in rejecting the said application and the ten claims thereof and refused plaintiffs a patent therefor. On or about July 28, 1948 applicants filed a request for reconsideration of said decision by said Board of Appeals, which request for reconsideration was denied on November 9, 1948. From said decision and denial for request for consideration by the Board of Appeals, no appeal to the Court of Customs and Patent Appeals has been taken, no such appeal is pending, and no such appeal has been decided.

XI

The following prior patents were referred to by the Examiner and the Board of Appeals in refusing a patent 103 for said application and claims:

Horst et al.	2,099,765	November 23, 1937
Lippert	2,148,316	February 21, 1939

XII

Plaintiffs allege that the Examiner and the Board of Appeals erred in rejecting the claims and in not holding each and all of said claims to be patentable, and the Examiner and the Board of Appeals erred in refusing plaintiffs a patent therefor.

XIII

Plaintiffs further allege that prior to December 7, 1944 plaintiffs, Florence M. Ford and William P. Hall, were the original, first and sole inventors of the invention disclosed and claimed in the said application, that said invention is new and useful, and was not known or used by others in this country before their invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country before their invention or discovery thereof, or more than one year prior to their said application, or in public use or on sale in the United States for more than one year prior to their said application, that said invention was not patented in any country foreign to the United States on an application filed by them or their legal representatives or assigns more than twelve months prior to the filing of their said application, and that no application for patent or said invention was filed by them or 104 their legal representatives or assigns in any country foreign to the United States prior to the filing of their said United States application.

XIV

Wherefore plaintiffs pray that the Honorable Court adjudge that applicants are entitled according to law to receive a patent for their invention as specified in the said ten claims and that the Commissioner of Patents be authorized and directed to issue such patent and for such other relief as may be meet and equitable.

Florence M. Ford, William P. Hall, Joseph Bancroft & Sons Co., by Cushman, Darby & Cushman, Attorneys for Plaintiffs, 712 American Security Building, Washington 5, D. C.

Synnestvedt & Lechner, Attorneys for Plaintiffs, 12 South Twelfth Street, Philadelphia, Pennsylvania. Of Counsel: Harvey L. Lechner, William M. Cushman.

105 Filed Feb. 8, 1949. Harry M. Hull, Clerk

* * * * * * * * * *

ANSWER TO COMPLAINT

To the Honorable the Judges of the United States District Court for the District of Columbia.

I, II, III, IV.

Defendant admits the allegations of paragraphs I, II, III, and IV of the complaint.

V.

He admits the allegations of defendant's position and admits that he is sued in his official capacity. He denies that his legal residence is in the District of Columbia but states that his official residence is in the District of Columbia.

106

VI.

He admits that on December 7, 1944 plaintiffs, Florence M. Ford and William P. Hall, filed in the Patent Office an application for patent entitled "Method of Producing Permanent Mechanical Finishes on Fibrous Materials". He admits that said application was given Serial No. 567,118.

VII.

He admits the allegation of the assignment of said application to plaintiff Joseph Bancroft & Sons Company.

VIII, IX, X, XI.

He admits the allegations of paragraphs VIII, IX, X, and XI.

XII.

He denies the allegation of paragraph XII. He states that claims 22 to 31, inclusive, of said application which are as set out in paragraph IX are unpatentable in view of the following prior patents and for the reasons given by the Examiner in his Statement and by the Board of Appeals in its decision, copies of which will be furnished at the trial:

Horst et al	2,099,765	Nov. 23, 1937
Lippert	2,148,316	Feb. 21, 1939

Profert is hereby made of copies of the above cited patents.

107

XIII.

He admits that in said application plaintiffs, Florence M. Ford and William P. Hall, made averments corresponding to the allegations of paragraphs XIII but defendant denies for the reasons aforesaid that such allegations are sufficient to justify the issuance of a patent on said application.

XIV.

Paragraph XIV is plaintiffs' prayer to the Court which paragraph defendant is not required to answer.

W. W. Cochran, Solicitor, U. S. Patent Office, Attorney for Defendant.

February 7, 1949

I hereby certify that a copy of this ANSWER TO COMPLAINT was mailed today, February 7, 1949, to the attorney for plaintiff, Cushman, Darby & Cushman, 712 American Security Bldg., Washington, D. C.

W. W. Cochran, Solicitor.

108 Filed Dec. 14, 1949. Harry M. Hull, Clerk

* * * * * * * * * *

ORDER

Upon consideration of the fact that John A. Marzall succeeded to the office of Commissioner of Patents on December 2, 1949, in place of Lawrence C. Kingsland, who resigned, and it appearing that there is substantial need for continuing and maintaining the above-entitled action, now therefore it is this 14th day of December 1949

Ordered that John A. Marzall, Commissioner of Patents, be and he is hereby substituted as party defendant in place of Lawrence C. Kingsland, formerly Commissioner of Patents.

H. A. Schweinhaut, Judge.

WE CONSENT: Cushman, Darby & Cashman, Counsel for Plaintiff. E. L. Reynolds, Counsel for Defendant and for John A. Marzall, Commissioner of Patents.

109 Filed Sept. 12, 1950. Harry M. Hull, Clerk

* * * * * * * * * *

ORDER

Upon consideration of the fact that one of the parties plaintiff, William P. Hall has since deceased, and it appearing to the court that the said Anne D. Hall is the duly qualified executrix of the estate of William P. Hall, deceased, now therefore it is this 12th day of September, 1950

Ordered that Anne D. Hall, as executrix of the estate of William P. Hall, deceased, be and she hereby is substituted as party plaintiff herein in place of William P. Hall, deceased, and granted leave to serve a supplemental complaint.

Alexander Holtzoff, Judge.

Counsel for Plaintiff. Counsel for Defendant. Copy sent to Counsel for Defendant, William M. Cushman, by R. J. Winter.

* * * * * * * * * *

11 EXCERPTS FROM TESTIMONY AND PROCEEDINGS

* * * * * * * * * *

Thereupon,

ROBERT C. SQUIER

was called as a witness and, being first duly sworn, testified as follows:

DIRECT EXAMINATION

By Mr. Klein:

Q. Will you please give your full name to the reporter, Mr. Squier? A. Robert C. Squier—S-q-u-i-e-r.

Q. Where do you live? A. 161 Forest Lane, Newark, Delaware.

Q. How old are you? A. Thirty-five years.

12 Q. Where are you employed? A. Joseph Bancroft & Sons Company, Wilmington, Delaware.

Q. What is the nature of their business? A. They have been in the dyeing and finishing of textiles for over a hundred years.

Q. In what capacity are you employed there? A. As a research chemist.

Q. For how long a time have you been employed in that capacity? A. Six years.

Q. What have your duties been, and have they been the same throughout that interval of employment? A. Yes.

Q. What are the duties of a research chemist? What are your duties as a research chemist? Excuse me. A. Those duties normally performed by a research chemist in the textile industry.

Q. Is your work principally in the laboratory? A. Yes.

Q. Do you have any occasion to work with the manufacturing departments? A. Yes, I do.

Q. Are you familiar with textile fabrics generally? A. Yes.

13 Q. Do you know how they are formed? A. Yes, I do.

Mr. Klein: I ask that the clerk mark this as Plaintiffs' Exhibit 1 for identification.

(A display card was marked as Plaintiffs' Exhibit 1 for identification.)

By Mr. Klein:

Q. I now show you Plaintiffs' Exhibit 1 for identification and ask you if you can identify it. A. Yes, I can. This is a card showing various steps in the manufacture of a fabric from the raw cotton as received by the weaver.

Q. Was this card prepared by you or under your direction? A. It was prepared under my direction.

Mr. Klein: I offer the card in evidence as Plaintiffs' Exhibit 1.

The Court: If there is no objection, it will be received.

(Plaintiffs' Exhibit 1 for identification was received in evidence.)

By Mr. Klein:

Q. Will you please describe what is shown on this card? A. In the upper left-hand corner of the card is a
14 batch of fibers representing raw cotton as received by the weaver. Several batches of these raw cotton

samples are mixed thoroughly and taken to the card, which is a combing machine, to remove most of the foreign materials and to more or less align the fibers.

This is shown in the center of the card and designated, "Web from card."

The third step in the manufacture of the fabric is designated by "sliver," which is in the upper right-hand corner of the card. This is a web drawn out and combed so that the fibers are aligned in more or less the same direction.

The fourth step is shown by the roving in the lower left-hand corner of the card. This is a sliver drawn out and given a slight twist.

The fifth step in the manufacture of the fiber is taking several rovings and twisting and drawing them out to form a yarn. This is shown in the center of the card at the bottom by warp yarn and the filling yarn, the filling yarn being on the right of the warp yarn.

These two yarns are taken to the weaving machine and woven into fabric, which is shown at the lower right-hand corner of the card.

Q. Referring to the sliver, Mr. Squier, can you indicate to the Court in any manner the fibers that go to make up the fabric? A. The fibers are indicated with the fuzz that is on the sliver.

Mr. Klein: Would Your Honor care to see the card?

The Court: Yes. That is all right.

By Mr. Klein:

Q. How many fibers would you say there are in the illustration of the sliver there, Mr. Squier? A. Well, that is hard to tell. There are at least thousands, probably hundreds of thousands.

Q. What type of fabric is shown on that card over the designation "fabric"? A. A cotton or cellulosic fabric.

Q. In the performance of your duties for Joseph Bancroft & Sons Company, have you had occasion to observe the mechanical finish on fabrics? A. Yes, I have.

Q. Is there more than one way of applying a mechanical finish to the fabric? A. There is.

Q. Is one of the ways of applying a mechanical finish to a fabric called or designated pressure mechanical finishing? A. Yes.

Q. How is a pressure mechanical finish produced
16 on textiles? A. A pressure mechanical finishing machine may be likened to a household ringer, in that the fabric passes between two rolls.

A pressure mechanical finishing machine consists of a much larger apparatus, the rolls being sometimes two feet in diameter and six feet long. They are composed of very hard materials.

Q. Do they exert any substantial pressure on the fabric? A. They exert tremendous pressures.

Q. Will you give us the name of the most commonly used machine for producing the mechanical finish? A. A calender.

Q. Of what material are the calender rolls in the textile calenders most commonly made? A. One roll is made of steel; the other roll is made of fibers pressed to a very hard surface on a steel core.

Q. What, if you know, is the purpose of the hard rolls and high pressures used in the type of pressure mechanical finishing that you have referred to? A. They are used to deform the fibers of a fabric.

Q. What is the range of pressures ordinarily used in the textile finishing calenders? A. Five to fifty tons on each end.

17 Mr. Klein: That is all for the present with this witness. We should like to call him later to testify in another phase of the case.

Mr. Schimmel: No questions.

(The witness left the stand.)

Mr. Aurich: Mr. Nickerson.

Thereupon,

RALPH F. NICKERSON

was called as a witness and, being first duly sworn, testified as follows:

DIRECT EXAMINATION

By Mr. Aurich:

Q. Doctor, will you give the court reporter your full name, please? A. Ralph F. Nickerson.

Q. Please keep your voice up, so that Mr. Schimmel can be sure to hear you. What is your address? A. 16 Pickett Street, Marblehead, Massachusetts.

Q. Your age is what? A. Forty-four years.

Q. By whom are you employed? A. By the Monsanto Chemical Company.

Q. How long have you been so employed? A. For four and a half years.

18 Q. Do you have any title or official position with Monsanto? A. I am a group leader in the textile research laboratory.

Q. What is a group leader? A. A group leader is the top man of a small group of technical investigators, responsible for administration, and primarily to see to the accuracy and the conduct of their experiments.

Q. How long have you been a group leader? A. For two years.

Q. Before you became a group leader, what was your position with Monsanto? A. I was a research chemist.

Q. Were you engaged in any particular field of chemical research? A. I have been doing textile chemical research during my whole stay with Monsanto.

Q. Does that include working with cellulose in the form of cotton? A. My whole work has been with the cellulosic material—that is, cellulosic textiles—and the application of synthetic resins to cellulose.

Q. You might give us the educational background, Doctor, that has prepared you for your work. A. Well, I

19 went to Massachusetts State College and took a bachelor of science degree in 1940. Incidentally, that is now the University of Massachusetts, in case there is any question. I took a master's degree from the same institution in 1932 and a doctor of philosophy degree in 1934.

Q. During your training in preparation for the doctorate, what was the major field of your study? A. Physical chemistry.

Q. Between the time of your obtaining your doctorate in 1934 and the time you were employed by Monsanto, what was the field of your work? A. I have worked primarily on cellulose, structural cellulose, cellulosic fibers, since 1937. In 1937 I went to work at Mellon Institute in Pittsburgh and worked for five and a half years on the structure of cotton fibers and the use of other derivatives of the cotton plant.

Q. Have you written any chemical treatises in connection with that problem? A. I wouldn't call them chemical treatises, but in the last thirteen years I have had published some twenty or twenty-five papers dealing with the structure of cellulose and with the application of resins to cellulosic materials, this being more recently, of course. I have
also, if I may modestly state, contributed chapters to
20 several recent books on textile fabrics.

Q. Are you a member of any technical societies? If so, will you tell us which ones? A. Yes. I am a member of the American Chemical Society, the American Association for the Advancement of Science, the Fiber Society, and the American Association of Textile Chemists and Colorists.

Q. I assume, Doctor, that you have had some considerable experience in the reading and interpretation of patents? A. That is part of a research man's job.

Mr. Aurich: I should like to offer in evidence as Plaintiffs' Exhibit 2 a certified copy of the file wrapper and contents pertaining to the application of Ford and Hall, involved here.

Mr. Schimmel: May I ask if that is the complete file?

Mr. Aurich: This is the complete file.

Mr. Schimmel: No objection.

Mr. Aurich: We will check it, Mr. Schimmel, before we go further.

(The file wrapper and contents referred to were marked as Plaintiffs' Exhibit 2 and received in evidence.)

By Mr. Aurich:

Q. Have you read the file wrapper and contents of the Ford and Hall application, Plaintiffs' Exhibit 2?

21 A. Yes, I have.

Q. Do you understand the process described in that application, which is claimed in the claims involved in this proceeding? A. Yes, I do.

Q. Do you have before you a copy of Claim 22, Doctor? A. Yes, sir.

Q. Have you read and studied that claim? A. Yes, I have.

Q. Will you briefly describe the process as set forth in that claim, according to your understanding? A. Well, the process consists of the sizing of textile fibers and fabrics with a water solution which contains polysaccharide carbohydrate, starch being a typical example, and also contains an aldehyde, of which formaldehyde is a typical example; of drying the sized fabric or fibers to dampness; imparting a mechanical finish thereto with a pressure mechanical finishing device; and subjecting the material then to a cure in the range of 280 to 400 degrees F.

Two cures may be applied. This step may be carried out concurrently with the pressure mechanical finish or not, as the case may be.

Q. Does that complete your answer? A. That is it.

Q. Is the aldehyde that is contained in the solution

22 described in Claim 22 what might be termed a free aldehyde? A. Yes, sir, I would say so.

The Court: You said "free"?

Mr. Aurich: That is right.

The Court: What is the significance of that?

Mr. Aurich: That is going to be very important.

The Court: I just wanted to understand you. You are coming to it?

Mr. Aurich: Yes.

By Mr. Aurich:

Q. What is meant by the term "durable," as you have used it, and as it appears in the claim? A. I think the term "durable" in a textile sense usually means that the finish referred to will resist the action of conventional cleaning, such as washing, dry cleaning, or water spotting, and such things.

Mr. Aurich: May it please Your Honor, so that Your Honor will be able to follow the testimony and understand where we are going, just generally I propose to take that claim and explain the meaning of all the words which have a technical connotation, as well as all these technical problems.

The Court: All right.

By Mr. Aurich:

Q. Now, will you tell us what Claim 22 refers to
23 when it speaks of cellulose and regenerated cellulose
as the fibers and fabrics? Can you generally define those terms for us? A. Cellulose usually refers to natural cellulose. The only cellulose we know of is that which is produced in nature. Therefore, cotton fibers are natural cellulose. Regenerated cellulose is cellulose which has been natural cellulose but has been put through a series of operations and recovered, such as, for example, viscose and rayon.

The terms as used here imply that the chemical structure of the cellulose has not been altered, as, for example, by introduction of substituents—combined substituents—into the molecule.

Q. In the textile industry—and again I speak generally—what is the meaning of the term "sizing"? A. The usual connotation is a coating of fibers or fabrics for some specific purpose. For example, the warp yarns are sized and coated, so that the shuttle will pass readily between them in the weaving operation. So sizing is usually a preparation for some other operation; it is not an end in itself.

Q. I noticed that Mr. Klein in his opening statement referred to the term "size." Does size have a technical meaning in the textile industry? A. Well, size would be
24 any material that is used in the sizing operation.

Q. Will a size normally be a material that will go onto the fibers or go into the fibers? A. I think generally a size is one that goes onto fibers—more a coating, perhaps.

Q. Now, let us return to Claim 22 for a minute, Doctor. I notice that in the preamble to the claim we find the words, "sizing the material."

Does that term, as used in that claim, have any meaning different from that used generally in the textile industry? A. Perhaps a slightly different meaning, in the sense that there is something more happening here than coating. The large molecular wet material—for example, starch—would be a coating in the sense that the molecules are too large to penetrate the fibers; hence starch is deposited on the surfaces of the fibers. So anything in the water that does enter the fibers would impregnate the fibers.

Q. Do I understand you to say that water solution would impregnate fibers? A. Well, naturally, if you put the cloth in the water solution, and the starch is deposited on the outside, the fabric is exposed to the water, and the water will enter the fibers.

Q. Will the water carry any larger constituent that may be in the solution which is of low molecular weight?
25 A. Anything that is dissolved in the water and is of small enough size to enter the fibers will, of course, go into the fibers with the water.

Q. Would the aldehyde in the solution as set forth in Claim 22 be carried into the fibers with the water solution? A. Indeed, it would.

By the Court:

Q. You said, "Yes"? A. Yes.

By Mr. Aurich:

Q. Is it or is it not desirable to include with the formaldehyde an acid catalyst? A. It is desirable to include an acid catalyst.

Q. Would that catalyst be carried right into the fibers along with the water solution? A. Usually catalysts are low molecular weight materials and would be carried in.

Q. Can you give the Court a short, non-technical definition of a catalyst? A. Well, I will use this connection rather than a theoretical one: A catalyst in an example such as this is a material which will accelerate a reaction.

Q. Will the starch that is referred to in Claim 22 as being one of the aldehyde groups impregnate and penetrate into the fibers? A. I don't think I understand that question. 26

Q. Will starch—that is, in the water solution—penetrate into the fibers? A. No, it will not. It will be deposited on the outside of the fibers.

Q. You have already testified that starch is a polysaccharide carbohydrate? A. That is right.

Q. Is one of the purposes of sizing a material with water solution containing starch to get some filling or coating action on the fabric? A. That is usually what is desired in sizing with such a material.

Q. Is it also one of the purposes of sizing material with a water solution containing starch to produce a desirable result in terms of mechanical finish of the fabric? A. That would be true in this case.

Q. Do the polysaccharide carbohydrates include more than starches? A. Oh, yes; there are—cellulose, for example, is also a polysaccharide carbohydrate.

There are a number of vegetable gums, such as gum acacia, gum karaya, and gum tragacanth.

27 Q. Is it or is it not necessary that the polysaccharide carbohydrates that are used in the Ford and Hall process, and is described in their application,

dissolve or disperse in water? A. They must dissolve or disperse in either hot or cold water.

By the Court:

Q. You say "must" or "does"? A. They must.

By Mr. Aurich:

Q. Do methyl cellulose and hydroxy ethyl cellulose perform the same function in the process as described in the claim in the Ford and Hall application as starch? A. Yes, they do, provided they are the typical types that are water soluble or water dispersible.

Q. I am not sure, but I believe you have already testified that starch is a high molecular weight material. A. It is a very high molecular weight material.

Q. Can you give us any illustration of the molecular makeup of starch? A. Well, you might use as an analogy that the molecular of starch looks like a long string of beads. Each bead would be exactly the same as the next and every other bead. These beads have hydroxyl groups on each bead.

To get a little mental picture of what that might be, the
hydroxyl groups might be imagined to be horns stuck
28 out on the beads like the horns of a marine mine.

Q. Are the molecular structures of the other polysaccharide carbohydrates similar to that of starch? A. They are similar but not identical. Q. Would that be true of cellulose? A. That is true of cellulose.

Q. To get an idea of the length of those molecules of starch, can you estimate the number of beads that would make up an ordinary starch molecule? A. Oh, I would have to give you a range and say that if we took an average length, of, say, between a hundred beads and three thousand beads per molecule, that would represent most of the common starches.

Q. Is starch chemically active? A. No, starch is quite inactive chemically. As a matter of fact, it constitutes a large portion of our diets. It would not if it were active chemically.

Q. Now, going back to Claim 22 again, I note that it recites that the water solution, in addition to containing starch, also contains an aldehyde, and that formaldehye is one of the aldehyde group referred to in the claim. Is formaldehyde an active chemical? A. Formaldehyde is an extremely active chemical. It reacts readily with itself to form polymers, or aggregates, such as paraformaldehyde.

29 Also, as is well known, it is a powerful preservative, which means that it will stop the life process of bacteria and a multitude of organisms, which might be rotting flesh. It is a very good preservative because of its extreme chemical activity.

Q. When starch and formaldehyde are mixed in solution, what happens? A. The formaldehyde, being active, will attach itself to the hydroxyl groups of the starch; that is, it will attach itself to the horns on our marine mine reference —provided, of course, that there are enough horns available to accept all the formaldehyde that is present. If there is more formaldehyde present than can attach itself to the hydroxyls, then, of course, there will be molecules of free formaldehyde swimming around between the starch molecules.

Q. Is it desirable or undesirable, in performing the process described in Claim 22, that the free formaldehyde becomes attached to the horns on the beads of the hydroxyl groups? A. It is desirable for that to happen, yes, sir.

Q. Is it necessary? A. It is also necessary that it occur to some extent, but that there be formaldehyde beyond that.

Q. In other words, all of the hydroxyl groups on our bead will not react with the aldehyde or formal-
30 dehyde? A. I think that is so. The three hydroxyl groups on any one bead probably differ in their chemical affinities for formaldehyde. I think one or more may not accept formaldehyde as readily as some of its brothers.

Q. In the Ford and Hall process, does the reaction forming the resinous product continue until the mechanical finish step is applied, or does it stop before that occurs? A. It must not stop before the mechanical finish step is applied.

Q. Why is that? A. Well, you must preserve—To get durability of the pressure mechanical finish effects, you must preserve the possibility—the probability—of reaction between the cellulose and formaldehyde.

Q. What formaldehyde? Would that be free formaldehyde? A. That would be formaldehyde which was free to enter the fibers via the water solution and to react with the hydroxyl groups in the fibers.

Q. I noticed in your last answer, Doctor, that you said it "probably" would do this or that. Is there any doubt in your mind about it? A. No; that is a common technical expression. When one cannot see these things going on, one knows them by inference, and the technical man then protects himself by saying "probably." Even though
31 he says "probably," he is reasonably sure.

Q. From what you have said so far, I take it that because the aldehyde will not react with all of the horns or all of the starch molecules, you will enevitably have free aldehyde present in the Ford and Hall process, even though you put in the solution the exact amount of aldehyde theoretically needed to react with the starch? A. That is right.

Q. What, in your opinion, is the purpose of incorporating formaldehyde into the solution as is described in the Ford and Hall application, and particularly, now, Claim 22? A. Why, I think formaldehyde has two purposes. First, it must react with the hydroxyls on the starch as the solution is made up, and there must also be an excess or some free formaldehyde which will enter the fibers with the water solution and react with the cellulose to produce a durable mechanical effect.

Q. What, if anything, happens when the formaldehyde reacts with the starch? For example, does it decrease or increase the water solubility of the starch? A. The purpose of getting reaction of formaldehyde and starch is to decrease water solubility.

Q. What happens when you decrease water solubility of
starch with formaldehyde? A. Quite naturally it will
32 increase the fastness of that starch to washing, if
that starch is on a piece of fabric.

Q. You told us about the free formaldehyde reacting with the cellulose when it enters into the fibers. What happens when that occurs? A. When free formaldehyde enters into the fibers, it attaches itself to hydroxyl groups on the cellulose inside the fibers; and later, representing the curing step, a reaction is completed whereby that formaldehyde, through reaction with the cellulose, is able to fix definite deformations of the fiber, such as deformation to a plane surface which will tend to be retained.

Q. Could a durable mechanical finish on fabrics—textile fabrics, I am speaking of—be accomplished by the use of formaldehyde alone? A. Yes, it could, but the results would be pretty unpredictable.

Q. What do you mean by "unpredictable"? A. Well, it is very well known in the art that the reaction of formaldehyde with cellulose does not give you the same result if you carry it out several times and you seem to carry it out each time in exactly the same way. On one occasion you may get very little effect; on the next occasion, repeating
the same experiment, you might get much more effect
33 than you wanted, such as to embrittle the fabric.

Q. Would you as an expert in this field, Doctor, have expected that the necessary control of the formaldehyde cellulose reaction could be obtained by the combination of starch and formaldehyde as disclosed in the Ford and Hall application, to the end that predictable results would be assured? A. I would not have expected that result.

Q. You have mentioned—

By the Court:

Q. Before you leave that, sir, do you mean by that that you would not have expected to arrive at a predictable result? A. I mean by that that if someone had asked me if the addition of starch to the formaldehyde system would make the formaldehyde reaction with cellulose predictable in the sense that you could reproduce and get the same results time after time, I would have been surprised, or would not have expected you could do it that way.

By Mr. Aurich:

Q. You have mentioned that in the solution which is described in Claim 22 there was free aldehyde therein. On what do you base that opinion? A. Well, the claim says:

> "* * * a water solution containing a polysaccharide
> 34 carbohydrate and an aldehyde * * *."

I take that to mean with a water solution containing a free aldehyde.

Q. Is there anything in the specification of the Ford and Hall application that would lead you to believe that your interpretation of this claim is correct? A. Yes, there are a couple of places in the specification that say free formaldehyde must be present.

Q. At what point in that process must you have this free formaldehyde present? A. Well, you must have free formaldehyde in the water solution as it penetrates the fibers; otherwise you would not get free formaldehyde into the fibers—cellulosic fibers.

Q. Of course, this free formaldehyde must remain free until the heating step? A. It must remain in the cellulose.

Q. Until the heating step? A. Until the heating step.

Q. Let us return to Claim 22, if you will, please. What has been designated as element 3 is that after the material has been sized with the solution of starch and formeldehyde, the material is then dried to dampness. What is the purpose of drying the material to dampness? A. The purpose
is to get rid of the bulk of the water which has been
35 applied in the sizing operation. But the reason for
stopping the drying out of the dampness is that the
fabric shall contain enough water—must be soft and pliable, so that it will speed the deformation under the pressure

mechanical finishing. If the fabric were dried completely, it would resist taking that deformation.

Q. Following the drying step and the step which has been designated by the numeral 4, the mechanical finishing of the product by a pressure mechanical finishing machine, broadly speaking is there anything new to imparting to a fabric a lustrous mechanical finish by a pressure mechanical finishing machine? A. Oh, no.

Q. Was such an operation, speaking generally, now, known before the filing of the Ford and Hall application here in suit? A. It was already well known for many years.

Q. For many years? A. Prior to the filing.

Q. Now, the last step of the claim is curing of the treated material, and you know that the material is to be cured by heating from substantially 280 degrees Fahrenheit to substantially 400 degrees Fahrenheit. What is the purpose of this curing step? A. The curing step fixes the defor-
36 mation which has been imparted by pressure me-
chanical finishing. When I say, "fixes," I mean it fixes it so that it will be durable in the sense that we have already defined it.

Q. Is there any other function performed by the curing step? For example, does that have anything to do with completing reaction of the formaldehyde in the cellulose? A. Yes, it does. Of course, the first thing that happens when you start to cure fabric in the temperature range shown would be to dry out moisture that was left in where the fabric was damp. The next step, of course, would be to promote the reaction of cellulose with formaldehyde.

By the Court:

Q. I am sorry; I missed that. The second step would be what? A. To promote—after the water has gone—to promote the reaction of formaldehyde with cellulose, to complete that reaction.

By Mr. Aurich:

Q. Now, forgetting for a moment the Ford and Hall process, as described in the specification and the claim with

reference to the curing of fabric which has been sized with a solution of starch and formaldehyde, and confining your answer merely to the question of curing, is the art of curing fabrics which have been sized or coated with material
37 new? A. No, it is not.

Q. Was it new at the time of the filing of the Ford and Hall application here in suit? A. No, it was not. To my knowledge, it had already been commonly used for 14 years prior to that time.

Q. Was it equally as old to cure textile materials generally within the range described in Claim 22 of the Ford and Hall application? A. It was.

Q. That also was known many years before? A. Yes.

The Court: Suppose we take a recess at this time until five minutes of twelve.

(At this time a short recess was taken. The following then occurred:)

Mr. Aurich: At this time I should like to offer in evidence as Plaintiffs' Exhibit 3 a copy of United States Letters Patent No. 2,099,765, to which we have heretofore referred as the der Horst patent.

The Court: That is what you handed me?

Mr. Schimmel: That is what you have there.

The Court: There is no objection?

Mr. Schimmel: No objection.

(Copy of der Horst patent was marked as Plaintiffs' Exhibit 3 and received in evidence.)

38 By Mr. Aurich:

Q. Dr. Nicherson, have you read and are you familiar with the der Horst patent, Plaintiffs' Exhibit 3? A. Yes, I have and I am.

Q. Will you briefly describe the process that is disclosed in that patent? A. In a rough way, the der Horst process consists in mixing starch and formaldehyde in a solution—aqueous solution—

By the Court:

Q. Did you say a water solution? A. Aqueous solution—water solution—allowing the materials to remain in water solution for periods of 24 hours to a week, depending upon the particular starch that is involved. The end of the reaction is determined by the point at which the reaction product will still just form a paste in water. That is, its reaction is stopped just short of the place where the starch becomes insoluble.

Q. Then, der Horst deals with the product of that reaction to textile materials for the purpose of coating? A. That is correct; primarily for stiffening.

Q. Does the der Horst patent disclose the process of imparting a durable finish to textile fabric by sizing material
with a water solution containing a polysaccharide
39 carbohydrate and formaldehyde? A. No, it does not.

Q. In the der Horst patent, what is the purpose of the reaction between the starch and the aldehyde, as he describes it? A. Well, to reduce the solubility of the starch—the water solubility of the starch.

Q. And to provide increased durability of the finishes to washing? A. That is correct, of course—durability.

By the Court:

Q. It increases the durability by this application? A. Yes.

By Mr. Aurich:

Q. In the der Horst patent, is it essential that the starch be rendered less soluble in water than starch normally is? A. That is correct; it is essential.

Q. Is that an essential in the process that is described and claimed in the Ford and Hall application in suit? A. No, that is not an essential.

Q. Is it important to der Horst that the reaction should be completed while he is still able to form a paste with the
starch product? A. That is correct.

40 Q. Why is that? A. Because if he carries reaction
further and gets an insoluble product—that is, insoluble in water—he would not be able to make a smooth dispersion of that in order to apply as an even sizing or coating to the fabric.

Q. With reference to the importance of completing reaction, how does the der Horst patent differ from or compare with the process described and claimed in the Ford and Hall application? A. Where the reaction must more or less be completed in the der Horst patent, on the one hand, the reaction must not be completed in the Ford and Hall process, on the other hand, because there must be still available free formaldehyde in that water solution, which can enter the fibers and react with the cellulose.

Q. Could the results that are sought to be obtained by Ford and Hall be accomplished if the reaction was completed as taught by der Horst? A. No, sir, they could not.

The Court: What do you mean by "results" there?

Mr. Aurich: I mean the obtaining of a durable—

The Court: And predictable result?

Mr. Aurich: And predictable result; yes, Your Honor.

By the Court:

Q. Are you saying in lay language to me, Doctor,
41 that under the der Horst patent, the predictability
is present, but in the Ford and Hall application it is
non-existent? A. Durability is non-existent.

Q. Both of them are durable, as I understand you. A. I don't think I understand your question.

Mr. Aurich: I think I can get it for you, Your Honor.

The Court: All right, suppose you try.

By Mr. Aurich:

Q. The product that is produced by the Ford and Hall process produces a durable, lustrous, mechanical effect? A. That is correct.

Q. Does the process as disclosed by der Horst, or will the process as disclosed by der Horst, produce a durable, lustrous, mechanical effect? A. No, it will not.

Q. Insofar as predictability is concerned, is there any difference between the solution in the Ford and Hall application and the solution in der Horst? A. Each in its own sense. I am sure that the application of the der Horst material will predictably give a stiffening or coating, but will not give the durable, mechanical finish as in this case—in the Ford and Hall case.

By the Court:

Q. Do you mean by that immunizing it from spot-
42 ing, and so forth and so on? A. That is correct.

Mr. Aurich: Does that answer the question Your Honor had in mind?

The Court: Yes, that is what I had in mind.

By Mr. Aurich:

Q. We have now spoken about the free formaldehyde that is present in the solution in the Ford and Hall process, and we have pointed out that that free formaldehyde is in the solution when the solution is applied to the fabric. A. That is right.

Q. Does der Horst teach a process or disclose a process in which there is free formaldehyde in the solution at the time the solution is applied to the fabric? A. No; at least, there is very little free formaldehyde present in those solutions.

Q. Speaking of der Horst? A. Yes, speaking of the der Horst process, that is so.

Q. Is there a sufficient amount of free formaldehyde present for purposes of reaction? A. In my opinion, there is not.

Q. Would you call the solution as disclosed in the der Horst patent a free formaldehyde solution? A. No, sir, I would not, anymore than I would call ordinary drinking water which has been treated with chlorine for pur-
43 poses of purification a solution of chlorine.

Q. If you wanted to produce a durable mechanical finish by the process disclosed in the der Horst patent, could you do so by the mere addition of formaldehyde? A. Well, not by the mere addition. I think one would have to experiment with the amounts added to arrive at a workable amount to add.

Q. Is there anything in der Horst which suggests that additional formaldehyde should be added to his solution? A. No, except in one case, in one of the examples, he suggests the addition of formaldehyde after he has carried out a reaction of starch and formaldehyde, but he also suggests the addition of starch at the same time.

In other cases, the addition of starch would counter the addition of formaldehyde in the opposite direction from formaldehyde.

Q. What differences, if any, flow from the fact that there is no free formaldehyde in der Horst, while there is in the Ford and Hall solution? A. The important difference is that with the application of the der Horst process, no free formaldehyde, or not enough for reaction purposes, would get into the fibers through impregnation of the fibers with the aqueous solution; whereas, on the other hand, in the case of the Ford and Hall process, since there is free formaldehyde in that water solution, the water which does
44 penetrate the fibers will carry with it free formaldehyde to the cellulose internally.

Q. In other words, if I understand you correctly, if you treated the textile fabric with the process disclosed in der Horst, and then you dried that fabric to dampness, pressure mechanically finished it, and cured it within the temperatures set forth in the Ford and Hall application, you would not obtain a durable mechanical finish; is that right? A. In my opinion, you would not.

By the Court:

Q. When you say "durable," do you mean lasting qualities, such as immunization from certain spotting? A. No; the ability to resist the effects of washing. Let me illustrate that by using a raincoat as an example. There are two types of water repellents applied to cloth for the purpose of making raincoats. One, for instance, is a dispersion of paraffin wax, which works very well, but the moment that coat goes to the dry cleaner's, all that wax will be taken off, and when the coat comes back to the user it will be as absorbent as a bath towel.

However, there are processes and chemicals that can be applied to cloth which are durable in the sense that a coat can go to the dry cleaner's, be cleaned, come back, and still be water repellent without any further or additional treatment at the dry cleaner's for the purpose of making
45 it water repellent.

That is what we mean by "durable"—that that water repellent finish of durable type should withstand laundering, so that the fabric can be washed and dried and still be water repellent. It may not be as fully water repellent as it was the day it was purchased new. It may lose a little more at each washing, but it does not lose it all.

Q. Now, being specific as to der Horst and Ford and Hall, the example which you gave with reference to the raincoat would be one which would go out and come back empty of what would be desirous, in your opinion; whereas, the other one would go out and come back possibly with some dilution, but not of a consequential nature, for a while at least? A. That is correct.

By Mr. Aurich:

Q. I want to get these two reaction processes that we have been talking about here just a little clearer, so that we will understand them.

If I understand your testimony correctly, in the process as described and claimed in the Ford and Hall application there is a reaction that occurs when the starch and the formaldehyde are placed in solution; is that right? A. That is correct. Formaldehyde molecules attach themselves to the starch hydroxyl groups, or those horns on the beads that we were talking about.

46 Q. Then, in that same Ford and Hall process, there is another reaction that takes place between the formaldehyde and cellulose at the time of the curing of the fabric; is that right? A. That is correct. You see, the water solution containing free formaldehyde enters the fibers, the free formaldehyde in that solution attaches itself to the horns on the beads of the cellulose inside the fibers,

and then subsequently, when that fabric is heat-treated or cured, a further reaction occurs, which fixes or stabilizes the effects durably.

Q. In the der Horst patent there is a reaction that occurs when the formaldehyde and starch are placed in solution? A. That is right; the same reaction.

Q. The same reaction we had in Ford and Hall? A. In the first part.

Q. In der Horst is there any reaction between the formaldehyde and the cellulose, as he has described his process? A. No, there will be no reaction between the cellulose and formaldehyde, because there will be insufficient formaldehyde to enter the fibers to attach itself to the cellulose and later be reacted with that cellulose.

Q. Somewhere along the line today I believe you
47 testified that der Horst definitely wants to complete
his reaction between formaldehyde and starch before the solution is applied to the fabric. Do you remember that? A. Yes.

Q. Is there anything in the der Horst patent to which you could point which would indicate that that was his objective? A. Well, there are several places in the patent specification. On the first page, line 43, it says:

> "* * * The period of the interaction of formaldehyde and starch depends on the special kind of starch used; it is so selected that the starch is still capable of yielding a paste after the said interaction is completed."

Then, a little further down, in line 51 he says:

> "* * * After the reaction between formaldehyde and starch the reaction product formed is dried,"

and so forth. That is after the reaction, which I understand to mean that the reaction is substantially completed.

By the Court:

Q. Do you treat that as completed? A. Yes.

By Mr. Aurich:

Q. Is there any teaching or disclosure in the der Horst
patent of drying the material to dampness after it
48 has been treated with the solution? A. Not specifi-
cally so, although I presume the fabric would pass
through a state of dampness on its way from completely
wet to completely dry.

Q. In other words, it would be a passing of that? A. Yes.

Q. Is there any teaching or disclosure in the der Horst patent of a mechanical finish of products which have been treated with solution? A. No, there is not.

Q. Is there any teaching or disclosure in the der Horst patent of curing material by heating from substantially 280 degrees to substantially 400 degrees? A. No, there is none.

The Court: While you are at that point, I understand there is an accord so far as 3, 4, and 5 are concerned? They are old?

Mr. Aurich: There is no question about that. My only point is to illustrate that der Horst does not have the same problem at all that we have in the Ford and Hall application, of imparting a durable mechanical finish. That is not what he is trying to do at all. I merely point that out and illustrate it for that reason only. I do not mean to go back on the fact that those steps are old and were old and well known to the art.

49 The Court: Am I understanding you to say that to
reach the result which der Horst has in mind, it would
not take steps 3, 4 and 5?

Mr. Aurich: No; I say if you take 3, 4, and 5 in the der Horst, you will not reach the result reached by Ford and Hall. That was a durability question.

The Court: I understand that these three steps are old; that there is nothing new in them?

Mr. Aurich: That is right.

The Court: Then, for your comparison purposes, you are saying now, as to the two reactions which take place in the patent application under consideration as related to the der Horst, that in the application under consideration there are two reactions which occur, whereas in the der Horst there is one, which is to all intents and purposes merely complete?

Mr. Aurich: That is right.

May I ask what time Your Honor recesses?

The Court: Is this a good time for you?

Mr. Aurich: Yes.

The Court: Then, we will come back at 1:45.

(At 12:30 p. m., a recess was taken until 1:45 p. m. of the same day.)

50 AFTERNOON SESSION

(The trial was resumed at 1:45 p. m., upon the expiration of the recess.)

Mr. Aurich: I have no further questions on direct examination, Your Honor.

Thereupon,

RALPH F. NICKERSON

resumed the stand and, having been previously duly sworn, testified further as follows:

CROSS EXAMINATION

By Mr. Schimmel:

Q. Dr. Nickerson, you in your testimony have been talking about free aldehydes. In your study of Claim 22, do you find any designation of free aldehyde in that claim? A. Only implied in the word "aldehyde" as present in the solution.

Q. Do you find any statement of free aldehyde in the application on which this proceeding is based? A. I believe if I could examine it I could find such a place.

(After examining paper) I have it.

Q. Would you mind pointing out the places where the words "free aldehyde" are used? A. The bottom of page 6.

By the Court:

51 Q. Is that the application, sir? A. Yes, sir.

Mr. Aurich: That is the application contained in the file wrapper in Exhibit 2.

The Court: It is the application?

Mr. Aurich: Yes, Your Honor.

By Mr. Schimmel:

Q. Would you mind reading the language that you find that says "free aldehyde"? A. "* * * it is desirable to add more than the amount of aldehyde used in reacting with the carbohydrate."

By the Court:

Q. Wait a minute, please. I am not hearing you. The acoustics in this room are terrible. Would you read that again, please? A. "* * * it is desirable to add more than the amount of aldehyde used in reacting with the carbohydrate."

By Mr. Schimmel:

Q. Does that mean to you that it is necessary to add more? A. Not necessarily: it is desirable.

Q. In other words, the result could be achieved without having excess or what you call free aldehyde? A. No, sir.

Q. You say no, it would not be achieved? A. May
52 I hear the question again?

Q. Would the result that is sought for in this application be achieved if you did not have this excess aldehyde, that you were just reading from the application? A. That is right; it would not be.

Q. It would not be? A. It would not be; yes.

Q. Is that correct? A. That is correct.

Q. Does Claim 22 say there must be excess aldehyde? A. It says there must be aldehyde.

Q. Would you look at the claims again, please? I refer you to Claim 25. Would you mind reading Claim 25? A. "The process of Claim 22 in which an excess of aldehyde over the amount required to react with the carbohydrate is employed."

Q. Having compared Claim 22 with Claim 25, would you say that you have to have an excess of aldehyde in Claim 22? A. We are saying we have to have aldehyde, in Claim 22.

Q. I am speaking of excess aldehyde, and that excess aldehyde was your definition of free aldehyde, as you have previously testified to, I believe. A. That is right.

Q. Now, can you use aldehyde without saying, “free,”
“excess,” or “excess aldehyde” in this process? A.
53 Provided you imply that you have aldehyde in that
solution as aldehyde.

Q. Now, let me ask you this: When you have paraformaldehyde, which is one of the materials recited in Claim 22, would you have aldehyde in that solution? A. Not as free aldehyde.

Q. You would have aldehyde, though, wouldn't you? A. You would have a polymer of aldehyde.

Q. If you use paraformaldehyde, do you get the results set forth in the Ford and Hall application? A. You will, provided the paraformaldehyde breaks down and yields free aldehyde.

Q. Does that ever take place in the water solution? A. It could take place in the water solution.

Q. Does it take place in the water solution? A. Under the proper conditions, it does.

Q. Does it take place when you dissolve the matters in the water solution? A. Not immediately.

Q. Does it take place when you size the fabric with the solution? A. Not because you size the fabric with the solution.

Q. When does it take place? A. Paraformaldehyde will
break down under alkaline conditions under water slowly
at room temperature; more rapidly if the solution is
54 heated.

Q. We do not have those conditions here, do we, necessarily? A. Not necessarily.

Q. Isn't it a fact that the preferred examples in the application have acid conditions instead of alkaline conditions? A. It is desirable to have an acid condition.

Q. So if you use paraformaldehyde, what would you characterize as free aldehyde in that solution? A. The decomposition product of the paraformaldehyde to free formaldehyde. Only that amount of the para which decomposes to water soluble.

Q. When would that occur? When would the decomposition occur? A. I expect it would occur at room temperature, if you waited long enough.

Q. When does it occur in this particular process, if I may ask? A. It must occur while the formaldehyde is in the water.

Q. You would say it occurs while it is in the solution—in the water? A. Yes.

Q. Prior to heating the fabric? A. It could be if the water were heated prior to application to the fabric.

Q. There is no indication of heating the solution prior to the application, is there? A. No; in claim—

Q. Claim 22 has no heating of the solution, does it? A. No, sir, it does not.

Q. While we are speaking of free aldehyde, would you mind looking at page 5 of the application in suit? In lines 7 and 8 on that page the term "hexamethylene tetramine" is used. Will that material itself in water give you free aldehyde? A. It will not.

Q. Hexamethylene tetramine will operate to give the result in this particular process, won't it? A. Yes, sir.

Q. So, in other words, if we use hexamethylene tetramine, we do not have to have free aldehyde; in fact, we can't have free aldehyde? A. We have available formaldehyde.

Q. But not in the water solution? A. That is correct.

Q. I believe you testified that generally or preferably an acid catalyst was used in the solution that was applied to the fabric under the Hall and Ford process; is that correct? A. That is correct.

Q. That acid catalyst, preferably, is what? Can you name it? A. Ammonium thiocyanate.

Q. Is that set forth in one of the claims involved in this case, if you know? I should like you to refer to Claim 30. A. Yes, it is set forth in Claim 30.

Q. Does ammonium thiocyanate react to formaldehyde? A. Yes.

Q. What does it produce when it reacts? A. Thiocyanic acid, a formaldehyde ammonia product.

Q. Technically speaking, to be correct, would you call that a catalyst in this process? A. Yes, sir.

Q. Even though it takes part in the reaction? A. In the textile industry, ammonium salts are commonly referred to as catalysts in connection with the curing of synthetic resins.

Q. Wouldn't it be true to say that when Ford and Hall use ammonium thiocyanate, starch, and formaldehyde, we have a resinous product formed in that solution between the ammonium thiocyanate and formaldehyde? A. Between the ammonium thiocyanate and formaldehyde?

57 Q. Yes. A. No, that is not a resinous product.

Q. You said before they reacted? A. Ammonium thiocyanate and the formaldehyde will react.

Q. Will react? A. That is right.

Q. But you do not believe they form resinous materials when they react? A. When they react by themselves, no.

Q. Are you familiar with Mr. Ellis' book on The Chemistry of Synthetic Resins? A. I have heard of the book.

Q. Do you know that Mr. Ellis is recognized as an authority in the field of resins? A. Yes, sir.

Mr. Schimmel: I have here, Your Honor, a copy of this book, The Chemistry of Synthetic Resins, in which the recognized authority, Carleton Ellis, has a portion which I should like to have the witness read, if I may. Under the first title, Thiourea Resins, he has a subdivision, Thicyanate Compositions. I should like the witness to read the third paragraph, beginning with, Experiments.

The Court: Page what?

Mr. Schimmel: Page 659. I will introduce a copy
58 of this into evidence, Your Honor.

The Court: All right.

The Witness: Read that out loud?

By Mr. Schimmel:

Q. Read it to yourself; you do not have to read it aloud. A. All right.

Q. Does the author there say that ammonium thiocyanate and formaldehyde react to give a resin? A. He does. He also, however, says the ammonium thiocyanate is put in a minimum amount of water necessary to dissolve it. That indicates a concentrated solution of thiocyanate, which is not the case in ordinary textile catalysts.

Q. Would you mind reading the sentence, then, beginning with, "When two molecular proportions"? A. All right.

Q. Would that change your opinion with reference to the last question or not? A. No, sir, it would not.

Q. Formaldehyde as commercially sold is only 30 percent solution? A. Thirty-seven percent.

Q. So would it necessarily mean that that would have to
be a concentrated solution to get that result? A. One
59 might get it in diluted solution, but one certainly
would not get resin, colloidal dispersion, or even
some molecular reaction product.

Q. You would not get a resinous reaction product? A. Not in the concentrations as employed.

Q. Is it your understanding that the expression, "polysaccharide carbohydrate," would be inclusive of ethyl cellulose? A. If you would alter that to make it modified polysaccharide carbohydrate, I would answer, Yes.

Q. Didn't you testify, though, that it was inclusive of methyl cellulose? A. That same answer applies to methyl.

Q. In other words, you are changing your previous testimony? A. The backbone of the material is polysaccharide.

Q. Do you disagree with the inventors here, who have included methyl cellulose as polysaccharide material? A. Oh, I don't disagree with them, unless one wishes to pin-point it. Then I would have to say: a modified polysaccharide carbohydrate.

Q. It is your understanding, you mean, that polysaccharide carbohydrate is not inclusive of methyl cellulose? A. Methyl cellulose is a modified polysaccharide carbohydrate.

60 Q. But the expression, "polysaccharide carbyhydrate," would not, in your opinion, include methyl cellulose? A. I think it would include methyl cellulose, yes.

Q. By the same token, it would include ethyl cellulose, would it not? A. All right.

Q. When you spoke of the der Horst patent, I believe you indicated that your understanding of that patent was that he reacted the starch with the aldehyde to complete reaction; is that true? A. He stopped his reaction and completed it short of that place at which he gets an insoluble or nondispersible product, yes.

Q. Isn't it true that he says that you can react those materials over various periods of time? A. Depending on the kind of starch employed.

Q. Do you have any recollection of what those periods are? A. Oh, from a day to a week, as I recall.

Q. Would the result of a day's reaction be the same as that of a week's reaction? A. It might be the same. I think the examples are not clear on that point.

Q. You yourself have not made any investigation
61 of that, you have? A. I have not.

Q. Do you know that Ford and Hall say in their application that they can react starch and formaldehyde for a considerable period of time? A. I recall there is mentioned there heating their mixes, but not the use of the word "reacting."

Q. I should like to refer you to page 12.

The Court: Of the application?

Mr. Schimmel: Of the application, yes, Your Honor.

By Mr. Schimmel:

Q. The paragraph beginning under the last example, N. Would you mind reading the first sentence of that paragraph? A. "The carbohydrate (one or more), aldehyde and catalyst may be mixed together and semireacted by heating the solution or dispersion of the ingredients for an appreciable time."

Q. I notice they use the words "appreciable time." Have you any idea of what that means? A. Oh, appreciable is one of those elastic words which means different things in different connections.

Q. Could it mean a day, do you think, or 24 hours? A. Well, depending on your point of view, it could, yes.

Q. You also stated with respect to der Horst that there
was no free aldehyde in der Horst's composition; is
62 that correct? A. I think I qualified that to say that
to say that there was not enough for purposes of
reaction.

Q. In other words, you mean there might be? A. There might—a little.

Q. There may be some free formaldehyde? A. Some very little amount, but insufficient for the purposes we are talking about; yes, sir.

Q. Is your statement made after studying the methods that der Horst specifies in the examples in his patent? A. Yes.

Q. I should like to read a statement made by the Examiner in this case and ask you whether you agree or disagree with that statement.

Mr. Schimmel: That will be under C in this folder, Your Honor.

The Court: Yes, sir.

Mr. Schimmel: On page 3, this statement appears—

Mr. Aurich: Page 3 of what?

Mr. Schimmel: Of the Examiner's statement.

Mr. Aurich: Pardon me.

By Mr. Schimmel:

Q. This statement is made:

> "* * * The examples shown in Horst set forth large proportions of formaldehyde which indicate an excess of formaldehyde." 63

Do you disagree with that statement? A. I will disagree with it because it is incomplete—not as you have read it, understand, but the implication is incomplete.

Q. Would you mind expounding on that a little? A. If I may refer to der Horst's patent, I will take Example 1 on page 2:

> "500 parts of potato starch are reacted for 7 days at ordinary temperature with 330 parts of a 30 percent formaldehyde solution and subsequently dried at 45 degrees C. in vacuo."

That means, of course, that any formaldehyde which is in excess of the amount that will react with the starch will be lost in the vacuum drying, because formaldehyde is a gas itself in water at ordinary temperatures; but when you remove the water, you will remove the excess formaldehyde.

Q. Is there any example in der Horst to which that statement of the Examiner applies? A. In my opinion, there is not an example here.

Q. In your opinion, there is not? A. There is not an example here which meets that specification.

Q. In other words, even if you had an example which did not evaporate to dryness, in which the proportions of starch and formaldehyde were those as in Example 1, you would still make that statement? A. I think that is a large amount of formaldehyde. No, I would not make that statement if there was such an example. 64

Q. Would you mind looking through the examples to see if there is one like that, without the evaporation?

Suppose I ask you this: Would Example 6 have a proportion of formaldehyde which would be in excess? A. That is dried—subsequently dried—at 50 degrees.

Q. You are right; it is. Take Example 11, then. A. There is no free adehyde indicated in that example.

Q. In other words, you are now saying that formaldehyde would not be free aldehyde? A. That is what I said before.

Q. That is what you said before, and you are still sticking to that? A. That is what I said. I am still sticking to that.

Q. O.K. I just wanted to get it straight.

Take Example 4. Would you say that there is any excess aldehyde there? A. I would say not.

> "5 parts of rice starch, 1.5 parts of a 30 percent formaldehyde solution * * *."

65 I made a rough calculation that you would have to have approximately equal parts of 30 percent formaldehyde and starch to have the amount that would combine theoretically, although that would still leave an excess—

Q. In other words— A. (Continuing) because of the latent reactivity of, say, one of the hydroxyls.

Q. You do admit that you do not have to have actual proportions—molecular proportions—in order to have reaction, because you do not get complete reaction, do you? A. That is right.

Q. You testified also with respect to der Horst that der Horst did not dry his fabric to dampness. What would you call the drying that der Horst speaks of in Example 5? A. "The material is then slung off."

Q. Would you mind explaining what that means? A. I mean that the material is put in a centrifuge and whipped around very rapidly, which will throw off surplus liquid.

Q. You would call that wet, not damp? A. Wet pickup—that is, wet fabric, of about the same moisture content as you would get by passing it through a mangle.

Q. When that wet fabric, as you have characterized it, is ironed as der Horst says, will it become damp?
66 A. As I said this morning, it will pass through a damp stage in getting from wet to dry.

Q. So it would pass from wet to the damp, and then it is heated at the temperature of the iron? A. It is heated all the time, while it is wet until it is dry, if the ironing is completed.

Q. Would you call the ironing that der Horst speaks of in that example a mechanical pressure finishing? A. No, sir, I would not.

Q. Why? A. The pressures are not high enough.

Q. Do you then mean that the mechanical pressure of finishing must be of a specified type to be mechanical pressure? A. I may be misreading this example, but when one says, "are ironed," I think of hand ironing.

Q. I agree with you. I think he means hand ironing, because he is talking of collars. Of course, we have pressure applied in ironing collars. A. I don't believe we would call hand ironing, pressure mechanical finishing, in the sense that it is understood in the industry.

Q. Collars are also ironed through iron rollers, aren't they? A. On home mangles.

67 Q. Yes. Am I correct? There is pressure there too, isn't there? A. That is right. However, there is one little difference. One irons against a soft background, and in pressure mechanical finishing one has a hard background. It is the steel on a hard fiber roll; whereas, my wife's ironing board, anyway, is padded very well, and she has a mangle which consists of one metal surface and a padded roll that runs against it.

Q. I call you attention, in that connection, to one of the other claims that is in this complaint, Claim 31. I note in Claim 31 that the mechanical finish is said to be a friction glazing. Isn't that essentially what the mechanical finish of Claim 22 under your interpretation would be? What I mean is, Is there any difference between the two claims, the way you have interpreted them? A. Yes, there would be a difference between straight mechanical—pressure mechanical—and a glazing, because embossing differs from glazing, if I may make that distinction. Pressure mechanical finishing is the more general. Friction glazing is a specific example of pressure mechanical finishing.

Q. Is the pressure you are speaking of in both cases the same type of pressure? A. It is extremely high in both cases.

68 By the Court:

Q. In both 21 and 22? A. And 22; that is right.

Mr. Schimmel: At this point, Your Honor, although there has been no direct examination of this witness with respect to the Lippert patent, I believe, under the qualifications of this witness, I am entitled to examine him with respect to that patent as well.

The Court: Have you any objection, Mr. Aurich?

Mr. Aurich: Yes, Your Honor. In the first place, it certainly is not, as Mr. Schimmel admits, cross examination on anything testified to by this witness on his direct examination: (a) there was no reference to the Lippert patent; (b) the Lippert patent was not even mentioned by inference or innuendo; and (c) his testimony has been strictly confined to matters not relating to the Lippert patent at all. I respectfully suggest—

The Court: You are saying that it is beyond the scope of direct examination?

Mr. Aurich: Yes.

The Court: What do you say to that, Mr. Schimmel?

Mr. Schimmel: Technically, I think he is correct. I have no objection to his objection to my inquiring of this witness. The only reason I raised it was that when he was qualifying the witness, he asked the witness whether he was
69 familiar with patents; so in a sense he was almost qualifying him as a patent expert. That is the only reason I raised this point.

Mr. Aurich: Because you put a witness on the stand and say, "Are you familiar with and have you an understanding of patents," that certainly does not open up the cross examination as to all patents.

The Court: Not necessarily open it up, but if you are inquiring as to his qualifications, and as a result of that you want to go into a particular patent, that is another question.

Mr. Aurich: That is another question, Your Honor. I agree with that.

Mr. Schimmel: I am not inquiring as to his qualifications, no; I would not question those at all.

That is all, I believe, from this witness.

Mr. Aurich: That is all, Dr. Nickerson.

(The witness left the stand.)

Mr. Aurich: I should like to recall Mr. Squier. Mr. Squier performed certain tests in the presence of Mr. Schimmel. My examination is going to bring out what he did and what the results are.

The Court: Very well, sir.

Thereupon,

70 ROBERT C. SQUIER

was recalled as a witness and, having been previously duly sworn, testified further as follows:

DIRECT EXAMINATION

By Mr. Aurich:

Q. You are the same Robert C. Squier who has heretofore testified in this case? A. I am.

Q. Did you prepare, or were there prepared under your supervision, certain solutions referred to in certain of the examples given in the der Horst patent? A. They were done under my supervision.

Q. Were those examples thereafter treated with the solutions which had been so prepared? A. That is correct.

Q. You did the treating of the fabric yourself? A. It was done under my supervision.

Q. What examples of the der Horst patent did you use in preparing those solutions? A. We used Examples 5, 6, 9, and 11.

Q. Do you know why those particular examples of the der

Horst patent were selected? A. These were selected because they were the ones mentioned by the Patent Office.

Q. During the prosecution of the Ford and Hall
71 application? A. That is correct.

Q. Did you also prepare some solutions from examples given in the Ford and Hall application? A. That is correct.

Q. Did you thereafter treat the material or the fabric with the solutions so prepared? A. Yes.

Q. What examples of the Ford and Hall application did you use? A. Examples E, L, and M.

Q. What did you do with the materials which were treated with the solutions prepared from the examples of the der Horst patent and the examples in the Ford and Hall application? A. We treated a piece of fabric with each solution, hung them up in the air to partially dry, ran them through a heated glazing calender, and then subjected them to a heated atmosphere. Part of those swatches were then washed, the excess water squeezed out, and ironed dry.

Q. What was the temperature at which this treated material was subjected to heat after it had gone through pressure mechanical finishing devices? A. Three hundred degrees Fahrenheit.

Q. For how long a period of time were those
72 treated materials subjected to that temperature? A. For five minutes.

Q. Was each one of the fabrics that was treated according to the examples you have mentioned, either in the der Horst patent or the Ford and Hall application, dried, calendered, cured, and washed in the same identical manner? A. They were all done as closely as possible in exactly the same manner.

Q. Was anyone representing the defendant present at the time you performed those operations? A. There was.

Q. Who was that? A. That was Mr. Schimmel.

Q. Were the solutions which you used prepared in the presence of Mr. Schimmel? A. No, they were not.

Q. Do you know why it was not done? A. It was not done because some of the solutions required as much as eight days to prepare.

Q. In preparing those solutions, both of the der Horst patent and the Ford and Hall application, did you faithfully follow out the instructions of each of the examples which you prepared? A. Yes, I did.

73 Q. In preparing those fabrics, did you as closely as possible endeavor to follow the commercial practice of producing a finished fabric, taking into consideration, of course, that most of this work was being done in the laboratory? A. Yes, we followed as closely as possible the commercial practice of producing a durable pressure mechanical finish.

Q. In the textile industry, what is the finished fabric? The fabric which has been cured and not washed, or the fabric which has been washed? A. The fabric that has been washed.

Q. I now hand you four swatches, marked, "Ex 5," "Ex 6," "Ex 9," and "Ex 11," and ask you if you can identify them. A. Yes, I can. These are the swatches finished according to Examples 5, 6, 9, and 11 of the der Horst patent and given the drying, mechanical finish, curing, and washing.

Q. Are these the examples that were prepared when Mr. Schimmel was there? A. They are, all except for Example 11.

Q. Will you explain why that is so? A. Some difficulty was encountered with Example 11, in that it could only be passed once through the glazing calender, because it was creased and torn too badly for the other two passes which the other samples received.

74 Mr. Aurich: I would like to offer the four swatches offered by the witness as evidence, and I ask that they be marked as Plaintiffs' Exhibit 4.

Mr. Schimmel: No objection.

The Court: If there is no objection, they will be received.

(The four swatches referred to were marked as Plaintiffs' Exhibit 4 and received in evidence.)

By Mr. Aurich:

Q. I now hand you another group of four swatches, stapled together, and marked as Examples E, L, M, and M-1, and ask you to identify these for us. A. These are swatches of cloth run according to Examples E, L, and M of the Ford and Hall application, and washed.

Q. What is Sample M-1? A. M-1 has been run exactly the same as M, except that additional formaldehyde was added to the formula.

Q. Additional aldehyde over and above what? A. Over and above that called for in the formula M.

Q. What was the purpose of adding this extra formaldehyde? A. This additional formaldehyde was added to show that a slight addition of formaldehyde might be beneficial.

75 Q. Will you now compare the swatches in Exhibit 4 with the swatches in Exhibit 5 and point out any differences or comparisons? Identify both of them.

Mr. Aurich: I beg your pardon, Your Honor. I neglected to offer these swatches as Exhibit 5. I now offer the swatches identified by the witness and ask that they be marked as Plaintiffs' Exhibit 5.

The Court: You did offer those of the der Horst?

Mr. Aurich: That is right.

The Court: Nos. 5, 6, 9, and 11, and I understood there was no objection.

Mr. Schimmel: That is correct.

The Court: I have received them. Now, those yet to be received are E, L, M, and M-1?

Mr. Aurich: I offer them now.

Mr. Schimmel: It is not clear to me whether or not the first exhibit, Exhibit 4, was after washing or before washing.

Mr. Aurich: After washing.

The Witness: After washing.

By Mr. Schimmel:

Q. They are all after washing? A. That is right.

Mr. Aurich: Exhibits 4 and 5 are all after washing.

The Court: All after washing?

Mr. Aurich: All after washing.

76 The Court: That is, Plaintiffs' Exhibit 4 constitutes Examples 4, 6, 9, and 11.

Plaintiffs' Exhibit 5 constitutes Examples E, L, M, and M-1.

(The samples E, L, M, and M-1 were marked as Plaintiffs' Exhibit 5 and received in evidence.)

Mr. Aurich: Would you read the last question, Mr. Reporter?

The Reporter (Reading): "Will you now compare the swatches in Exhibit 4 with the swatches in Exhibit 5 and point out any differences or comparisons? Identify both of them."

The Witness: The samples of Exhibit 5 have a much higher luster than the samples of Exhibit 4; and, in my opinion, the samples of Exhibit 5 have a higher crease resistance than those swatches of Exhibit 4.

By Mr. Aurich:

Q. Would you say, as an expert in this textile field, that the swatches produced by the examples of the der Horst patent—Exhibit 4—and those produced by the examples of the Ford and Hall application—Exhibit 5—are or are not identical? A. They are definitely not identical.

77 Q. Still referring to Exhibits 4 and 5, which of the swatches in either of those exhibits would be acceptable commercially as a fabric having a durable mechanical finish applied to it? A. Samples E, L, M, and M-1 of Exhibit 5.

Q. None in Exhibit 4? A. The only one that might possibly be considered in Exhibit 4 is Sample 9, but the hand of 9 is too firm.

Q. What do you mean by "hand," in the first place, and the hand being "too firm," in the second place? A. "The hand" is an elusive term, but generally it means, How does the fabric feel when you actually put your own hand on the cloth? It can be too firm, it can be too soft, it can be dead, or it can be lively.

Q. I now show you another group of swatches and ask you if you can identify them for us, please. A. Yes, these are Samples 5, 6, 9, and 11 of the der Horst patent.

Q. They were mentioned before? A. Except that these have been cured only; they have not been washed.

Mr. Aurich: I now offer the swatches identified by the witness and ask that they be marked as Plaintiffs' Exhibit 6.

Mr. Schimmel: No objection.

The Court: If there is no objection, they will be received.

(Samples 5, 6, 9, and 11 of the der Horst patent referred to were marked as Plaintiffs' Exhibit 6 and received in evidence.) 78

By Mr. Aurich:

Q. I now hand you another group and ask you if you can identify them for us, please. A. These are samples of swatches run according to the Ford and Hall application, lettered E, L, and M, and there is an M-1 which has an addition of formaldehyde over the example M of the application.

Mr. Aurich: I now offer the swatches just identified by the witness.

The Court: If there is no objection, they will be received.

(The samples E, L, M, and M-1 referred to were marked as Plaintiffs' Exhibit 7 and received in evidence.)

By Mr. Aurich:

Q. As I understand it, the only difference between Exhibits 4 and 5, on the one hand, and 6 and 7, on the other, is that Exhibits 6 and 7 have not been washed? A. That is correct.

Q. Will you compare the two swatches of cured and unwashed material, insofar as the glazing on the fabrics is concerned? I refer you to Exhibits 6 and 7. A. I am
79 very sorry; I have only Exhibit No. 7.

Q. I am sorry (handing an exhibit to the witness). A. The luster on all of these swatches is very similar.

By the Court:

Q. When you say, "similar," do you mean similar in 6 and 7, or do you mean within the one exhibit? A. I mean all of the examples in both exhibits.

The Court: Both. All right, sir.

By Mr. Aurich:

Q. Will you compare Exhibits 4 and 6, which I believe are the der Horst swatches? Has the glaze or luster on Exhibit 6 been retained on Exhibit 4? A. No, definitely not.

Q. Will you now compare the swatches in Exhibit 5 and 7 and tell us whether the glaze that was on Exhibit 7 is still on the swatches in Exhibit 5?

The Court: "Glaze" and "luster" are synonymous?

Mr. Aurich: Yes.

The Witness: The glaze or luster of Exhibit 5 is not quite as much as on Exhibit 7, but a great deal more than on Exhibit 4.

By Mr. Aurich:

Q. Does the glaze, whatever it may be, that is on Exhibit 5 indicate that that is durable to washing?

The Court: Do I understand that you are asking
80 him if the durability is dependent upon the glaze?

Mr. Aurich: No, Your Honor; durability to resist washing. It is the same question we had up with Dr. Nickerson this morning. By "durability" here, we mean its ability to withstand cleaning and washing only.

The Court: I understand that, sir, but I am asking you, Is that durability dependent upon the glaze?

Mr. Aurich: Depending upon the glaze remaining on the fabric after it has been washed, because the mechanical finish has not come off.

The Court: All right, sir.

Mr. Aurich: Would you read the question, please?

> The Reporter (reading): "Does the glaze, whatever it may be, that is on Exhibit 5 indicate that that is durable to washing?"

The Witness: Yes, it does.

By Mr. Aurich:

Q. Do the swatches in Exhibit 4, which are the der Horst washed swatches, as I recall it, indicate that they are durable to washing, insofar as mechanical effect is concerned? A. No, except for Sample 9, which has the other defect.

Q. Have you ever sized a fabric with the solution of starch and aldehyde as described in Claim 22 of the
81 Ford and Hall application, other than the test to which we have been referring? A. Yes, I have.

Q. Approximately how many times have you performed this operation? A. Oh, that is pretty hard to tell. At least a hundred times.

Q. In all those instances have you been able to secure a predictable result? A. Yes, I have.

Q. Now, in Example 9 of the der Horst patent, reference is made to a Foulard machine. Do you know what type of machine that is? A. Yes; a Foulard machine is a padding machine.

Q. Is it in any sense of the word a pressure mechanical finishing machine? A. No, it is not.

Q. How does a Foulard machine differ, generally speaking, from a pressure mechanical finishing machine? A. A Foulard machine handles cloth in the wet state, and the pressure mechanical finishing machine handles cloth in nearly a dry state or, in some cases, in the dry state, and exerts tremendous pressures on the fabric.

Q. If the wet cloth of fabric that is used in a Foulard machine were run in a pressure mechanical finishing 82 machine, what would happen? Would any effect whatsoever be obtained? A. You would give no mechanical effect.

Q. In Example 6 of the der Horst patent, reference is made to a Rackel-machine. Do you know what a Rackel-machine is? A. Yes, a machine that is used for sizing the back of a fabric.

Q. Could a Rackel-machine be used to apply a mechanical finish to a fabric such as chintz? A. No, a Rackel-machine would not give a pressure mechanical finish to the fabric because the cloth is in the wet state as it leaves the machine and exerts no pressure to the fabric.

Q. Speaking of the pressure finishing machines that are used in the textile industry, what is the pressure to the fabric that is employed in those machines? A. It is in the neighborhood of approximately a thousand pounds per square inch.

Q. Would you get the same result in ironing a fabric which has been treated with the solution described in the Ford and Hall application, using an iron, as you would by running it through a pressure finishing machine? A. Definitely not.

83 Q. How about running the fabric through an ordinary laundering mangle? A. Definitely not in that case either.

Q. Why not? A. Because, as I explained a minute ago, a pressure mechanical finishing machine exerts a pressure of about a thousand pounds per square inch; whereas, with an iron, pressures of five or maybe, at the very utmost, ten pounds per square inch would be applied.

Q. Would pressures of five to ten pounds deform the fibers? A. No.

Mr. Aurich: No further questions.

CROSS EXAMINATION

By Mr. Schimmel:

Q. Mr. Squier, in making these solutions that were used in making the swatches according to the Hall and Ford application, did each one of those solutions contain a catalyst? A. May I see the application, please?

(After examining paper) Yes, samples E, L, and M contained a catalyst.

Q. What was that catalyst? A. Ammonium thiocyanate in E, L, and M.

Q. In other words, none of those swatches were run with solutions without a catalyst; is that correct? A.
84 That is correct.

Q. Do you know why you did not try one without a catalyst? A. We had no reason to run any ones different than the ones we were told to run.

Q. Is it your understanding of the Ford and Hall invention that the solution must contain only starch and formeldehyde? A. It is possible.

Q. Yet you run no sample with such a solution, did you? A. You will have to remember that I was asked to run these particular samples. These are not ones that I picked myself.

Mr. Schimmel: I should like to call the Court's attention to that particular fact: that the claims in this case are broad enough to call for the use of a solution without a catalyst, and we have no comparison in the Ford and Hall invention with der Horst when there is no catalyst in the sizing solution.

By Mr. Schimmel:

Q. In your testimony you stated that the swatches that were prepared according to the Hall and Ford application were more crease-resistant than those prepared according to der Horst. On what do you base that opinion? A. I base that on the fact that the samples run according

85 to the Ford and Hall application contained formaldehyde at the time they were heat set—that is, heat treatment—and it has been well known that you can crease-resist fabrics by the use of formaldehyde.

Q. You ran no tests on that? A. Not on these particular samples.

Q. On these particular swatches? A. That was because the swatches were not big enough.

Q. Now, in the samples run according to Ford and Hall, I believe you stated that the difference between the sample M and the sample M-1 was that in sample M-1 there was an excess of aldehyde; is that correct? A. I believe I said additional formaldehyde.

Q. Additional aldehyde over and above what? A. Over and above that given in the formula as given in the application.

Q. So you have no intention to imply by "additional," necessarily free? A. In the specifications, I think it says that an excess of formaldehyde may be used, and this was run to show that the excess or additional formaldehyde over and above that given in formula M might be beneficial.

Q. Is there really any difference, in your opinion, between swatch M and swatch M-1? A. There is a very slight difference.

86 Q. You can determine a slight difference in what characteristics? You are talking of the swatch M and the swatch M-1, which is Plaintiffs' Exhibit 5, I believe. A. There is a slight difference in the hand and a very slight difference in the amount of luster.

Q. Would you say that to get the durability that we have been speaking about here today, it is not necessary to have this excess aldehyde? A. It is not necessary in this particular sample to have this additional formaldehyde.

Mr. Schimmel: That is all, Your Honor.

Mr. Aurich: The plaintiffs rest, Your Honor.

Mr. Schimmel: For the defendant, Your Honor, I should like to introduce as Defendant's Exhibit 1 the folder that you have on your desk, which includes copies of the two patents; the Examiner's statement; the decision by the Board of Appeals dated July 8, 1948; and the decision by the Board of Appeals on reconsideration, dated November 9, 1948.

The Court: Is there any objection?

Mr. Aurich: I have no objection, Your Honor.

(The folder referred to was marked as Defendant's Exhibit 1 and received in evidence.)

Mr. Schimmel: As Defendant's Exhibit 2, I should like to introduce the two pages of the Ellis book that I had the witness read, pages 659 and 660.

87 Mr. Aurich: No objection.

The Court: This makes it handy.

Mr. Aurich: Yes, Your Honor.

(Pages 659 and 660 of the Ellis book referred to was marked as Defendant's Exhibit 2 and received in evidence.)

Mr. Schimmel: That is all we have, Your Honor.

• • • • • • • • • •

93 The only claim that really defines "catalyst" is Claim 30, which says ammonium thiocyanate. You will note the difference between the two claims. One says a catalyst broadly; the other gives a specific material. The only improvement at all is with respect to ammonium thiocyanate. The witness has testified that there is improvement with respect to that material, and I accept that testimony. As far as that particular claim is concerned, I would say he distinguishes from der Horst. However, with respect to that claim it is my contention that Lippert comes into the picture. I think Lippert comes into the picture with respect to all the claims. We have had no testimony in this case with respect to what Lippert discloses, so I think I should briefly call the Court's attention to what I think are the highlights of this particular patent.

• • • • • • • • • •

110 Filed Nov. 1, 1950. Harry M. Hull, Clerk

October 31, 1950.

Attention: Messrs. Kline and Aurich.

Cushman, Darby & Cushman,
American Security Building,
Washington 5, D. C.,
Attorneys for Plaintiffs.

E. L. Reynolds, Esq.,
Solicitor, Attention: Joseph Schimmel, Esq.
United States Patent Office,
Washington 25, D. C.,
Attorney for Defendant.

Re: *Ford et al.* v. *Marzall,* Civil Action No. 5217-48.

Gentlemen:

I find that the process which plaintiffs seek to patent has been anticipated by the prior art, and does not reveal the flash of creative genius which makes for patentability.

The chemical compound used in plaintiffs' process is clearly anticipated by the Horst patent, and the method of application and finishing is anticipated by both the Horst patent and the Lippert patent.

While it may be that plaintiffs' variation of the basic process obtains more predictable results, I find that their combination and improvement of prior disclosures is such as flows from the natural development of the art by one skilled in the field, rather than from the "uncommon talent" which lies at the root of invention in a patentable sense. [*Standard Oil Development Co.* v. *Marzall,* 181 F. 2d 280 (U. S. App. D. C.).]

I therefore find for the defendant.

Counsel for defendant will please prepare and submit promptly appropriate findings of fact, conclusions of law, and order.

Very sincerely,

R. B. Keech.

* * * * * * * * * *

111 Filed Nov. 22, 1950. Harry M. Hull, Clerk

FINDINGS OF FACT

1. This is a civil action under R. S. 4915 (U.S.C. title 35, sec. 63) in which the plaintiffs, Florence M. Ford, Anne E. Hall, executrix of the estate of William P. Hall, deceased, and Joseph Bancroft & Sons Co., seek to have the Court authorize the Commissioner of Patents to grant a patent on the claims set forth in paragraph IX of the complaint, which claims are claims 22 to 31 inclusive of the Ford and Hall patent application, Serial No. 567,118, filed December 27, 1944, entitled "Method of Producing Permanent Mechanical Finishes on Fibrous Materials."

2. The Ford and Hall patent application describes and claims a process of producing mechanical finishes on 112 fabrics, such as cotton fabrics, which are durable or permanent in the sense that they will resist washings, such as with soap solutions or with dry cleaning solvents, without objectionable loss of finish. This result is accomplished, in accordance with the claimed process, by sizing the fabric with an aqueous solution containing a polysaccharide carbohydrate, starch being exemplary of such material, and an aldehyde, such as formaldehyde, with or without an acid catalyst; by drying the sized material to dampness (about 10% moisture); by subjecting the damp material to a pressure mechanical finishing machine, and by heating the treated material to a temperature within the range of 280°F to 400°F. The carbohydrate and aldehyde in solution form a reaction product which in curing during the final heating step forms a water insoluble product in and on the fabric.

3. The patent to Horst et al., 2,099,765, granted November 23, 1937 describes a process of finishing textile materials by treating them in an aqueous medium containing an aldehyde starch, and preferably an acid reacting substance, by removing excess treating solution, by passing the treated fabric through a finishing machine, and by heating the finished fabric while passing over drying cylinders heated by means of steam having a pressure of two atmospheres. The finished fabrics are described as being mechanically stable and fast to repeated washings with soap and soda.

113 4. The patent to Lippert, 2,148,316, granted February 21, 1939, describes a process for finishing chintz, providing a surface which will retain its lustre even after repeated launderings. Cloth is impregnated with an aqueous solution containing urea formaldehyde, ethyl cellulose and an acid catalyst, the impregnated cloth dried in a manner to retain about 10% moisture, and the dried cloth then passed through either a calendar or a glazing machine, in which the rolls are heated to a temperature in the range of 320°F to 400°F and in which a pressure of about 5 tons per square inch is applied.

5. The chemical compounds used in plaintiffs' process are clearly the same as those used in the Horst et al patent.

6. The method of application and finishing is anticipated by both the Horst et al patent and the Lippert patent.

7. While plaintiffs' variation of the basic process may obtain more predictable results and may be an improvement over the prior art, it is such as flows from the natural development of the art by one skilled in the field and is not invention.

8. The process which plaintiffs seek to patent has been anticipated by the prior art.

9. Claims 22 to 31 inclusive, here involved, are
114 unpatentable in view of the prior art.

CONCLUSIONS OF LAW

1. Plaintiffs are not entitled to a patent containing any of claims 22 to 31 inclusive set forth in paragraph IX of the complaint.

2. The complaint should be dismissed as to all the claims involved.

R. B. Keech, Judge.

* * * * * * * * * *

115 Filed Nov. 22, 1950. Harry M. Hull, Clerk

JUDGMENT

This case came on to be heard at this term and thereupon, upon consideration thereof, it is this 22nd day of November, 1950

Adjudged that the complaint be and it is hereby dismissed with costs against the plaintiffs.

R. B. Keech, Judge.

* * * * * * * * * *

116 Filed Dec. 21, 1950. Harry M. Hull, Clerk

NOTICE OF APPEAL TO COURT OF APPEALS UNDER RULE 73(b)

Notice is hereby given that Florence M. Ford. Anne E. Hall, Executrix of the Estate of William P. Hall, Deceased, and Joseph Bancroft & Sons Co., plaintiffs above named, hereby appeal to the United States Court of Appeals for the District of Columbia from the final judgment dismissing the complaint, entered in this Action on November 22, 1950.

William M. Cushman, American Security Building, Washington 5, D. C., Attorney for Plaintiff, Joseph Bancroft & Sons Co.

C. Willard Hayes, American Security Building, Washington 5, D. C., of Counsel.

Copy to: E. L. Reynolds, Esq., Patent Office.

* * * * * * * * * *

119 Filed Jan. 11, 1951. Harry M. Hull, Clerk

STIPULATED DESIGNATION FOR THE RECORD ON APPEAL

It is stipulated by and between counsel for the parties hereto that the record on appeal shall comprise the following documents and exhibits, and the Clerk is requested to prepare and certify the same:

1. Docket entries.
2. Complaint.
3. Answer.
4. Order substituting John A. Marzall, Commissioner of Patents, as Defendant.
5. Order substituting Anne E. Hall, Executrix of the Estate of William P. Hall, Deceased, as a party plaintiff.
6. Reporter's Transcript of Proceedings, at trial, October 30, 1950.
7. Opinion, dated October 31, 1950.
8. Findings of Fact and Conclusions of Law, filed November 22, 1950.
9. Judgment dismissing complaint entered November 22, 1950.
10. Notice of Appeal.
11. Order authorizing deposit in lieu of bond on appeal.
12. This stipulation. 120
13. Order with respect to physical exhibits.
14. Plaintiffs' physical exhibits:
    (1) Display card.
    (2) Certified copy of file wrapper and contents of Ford and Hall Application 567,118, filed December 7, 1944.
    (3) Copy of DerHorst Pat. No. 2,099,765.

(4) Four swatches of fabric treated with the materials of Examples 5, 6, 9 and 11 of DerHorst patent, after drying, mechanical finishing, curing, and washing.
(5) Four swatches of fabric treated with the material of Ford and Hall Examples E, L, M, and M-1, after mechanical finishing and washing.
(6) Four swatches of fabric treated with the material of DerHorst Examples 5, 6, 9 and 11, mechanically finished and cured, but not washed.
(7) Four swatches of fabric treated with the material of Ford and Hall Examples E, L, M, and M-1, mechanically finished and cured, but not washed.

15. Defendant's physical exhibits:
(1) Folder containing DerHorst patent, Lippert patent, the Examiner's Statement, Decision by the Board of Appeals, and Decision by the Board of Appeals on Reconsideration.
(2) Photostat of Pages 659 and 660 of Ellis text: "The Chemistry of Synthetic Resins."

January 10, 1951. William M. Cushman, American Security Building, Washington 5, D. C., Attorney for Plaintiffs.

January 10, 1951. E. L. Reynolds, Solicitor, United State Patent Office, Attorney for Defendant.

* * * * * * * * * *

EXHIBITS

[Portion of Plaintiff Exhibit 2]

* * * * * * * * * *

1 **SPECIFICATION**

* * * * * * * * * *

2 This invention relates to the production of permanent mechanical finishes on fabrics, such, for example, as cotton fabrics.

It is well known in the textile art that mechanical finishes may be imparted to fabrics, as by glazing, schreinering, calendering, beetling, and embossing. These finishes are ordinarily not permanent, i.e., they are not resistant to washing or the action of water.

The primary purpose of the present invention is to produce mechanical finishes which are permanent in the sense that they will resist the action of water and resist repeated washings, such as with soap solutions or with dry cleaning solvents, with no objectionable loss of finish.

We are aware that heretofore permanent mechanical finishes have been obtained by the process of United States Patents Nos. 2,103,293 and 2,148,316. The present process is a different way of accomplishing substantially similar results.

In carrying out our invention we apply to the fabric the
resinous product obtained by reacting a carbohydrate
3 and an aldehyde (preferably in the presence of a
catalyst) and thereafter imparting the mechanical
finish, and curing the resinous material in and on the fabric, the curing in some instances being done, in whole or in part, simultaneously with the imparting of the mechanical finish.

The resinous material may be applied to the fabric by any of the well known methods practiced in the textile art, such as impregnating, coating, back-filling, and the like.

After the resinous material has been applied, the fabric is partly dried and then submitted to the mechanical finishing operation, curing, washing, and drying. By partly drying we mean drying until there is about 10% moisture in the cloth, a good practical test for which is if the fabric feels slightly moist after the drying.

The resinous material is applied in the form of a size, i.e., an aqueous solution or mixture, as will further appear.

The carbohyrates used should be such as dissolve
4 in either cold or hot water, or such as will produce a
smooth colloidal dispersion in cold or hot water.
With certain carbohydrates, such as the unchanged

starches, this condition may be brought about by heating the carbohydrate, dispersed in water, either directly with the aldehyde or prior to the addition of the aldehyde. In particular, starches, or their substitution or degradation products, such as potato starch, corn starch, tapioca starch, partly acetylated starch, thin boiling starch, and dextrines may be used. Other carbohydrate products may also be used, providing they dissolve or disperse in cold or hot water, as hereinbefore described, such as gum tragacanth, karaya gum and gum arabic. Highly polymerized carbohydrate derivatives, such as methyl cellulose and hydroxy ethyl cellulose may also be used.

Of course, the carbohydrate must be such as is capable of reacting with aldehydes under the condition of the process to form water insoluble combination products.

For the aldehydes we prefer formaldehyde, although other aldehydes, such as glyoxal and acetaldol may be used. Also any of the polymerization products of formaldehyde, say, for example, paraformaldehyde, providing they furnish sufficient monomolecular formaldehyde under the reaction conditions to give the desired results. Compounds which liberate sufficient aldehyde during the curing operation may also be used, such as, for example, hexamethylene tetramine which decomposes during the curing liberating formaldehyde.

The catalyst employed may be varied so long as the reaction between the aldehyde and the carbohydrate is sufficiently increased by the presence of this material to make it economical and practical to use the catalyst. We prefer to use ammonium thiocyanate as this gives excellent results. We also mention zinc chloride, ammonium dihydrogen phosphate, and ammonium nitrate. In general, the pH of the cured fabric should have a value of from 4 to 5. At lower pH values excessive undesirable tendering takes place and at higher values the curing becomes excessively slow.

In some cases it is beneficial to heat the carbohydrate

and aldehyde, with or without the catalyst, as the case may be, prior to the sizing operation. The heat employed is preferably in the neighborhood of 200°F., say from
6 190°F. to just short of 212°F., in order to avoid objectionable loss of aldehyde. In other cases the carbohydrate may be made to form a solution or smooth colloidal dispersion, and, after cooling, the aldehyde, catalyst, and other desirable ingredients added. By such other desirable ingredients we mean ingredients not essential to the necessary chemical reactions taking place but desirable for the conductance of the mechanical procedures and to the production of any particular desired hand or feel. These ingredients may be added directly to the resinous size and applied with it, or may be applied before the application of the resinous size, or as a finishing operation after the curing, washing, and drying procedures. These ingredients comprise such products as softening materials, wetting agents, stiffening agents, etc. They form no part of the invention. If aldehydes are used during the dispersion of the carbohydrates, either with or without the application of heat, additional aldehydes and catalyst may be added before the size is applied to the fabric, together with other desirable ingredients.

By the heating described, the reaction between the starch and the aldehyde occurs. For practical considerations, it is desirable to add more than the amount of aldehyde used in reacting with the carbohydrate. Thus, there is
7 usually an excess of aldehyde present in the sized product, part of which reacts with the cellulose of the fabric during the curing and part of which is driven off in the curing. In the case of cellulose, for example, methylated cellulose is formed during the curing. This is not detrimental but at times beneficial as it adds to the durability of the finish provided the aldehyde is not present in such amounts that excessive action takes place in the cellulose, in which case undesirable loss of fabric strength will be obtained. Hence we prefer to use as small an excess

of aldehyde as will give a satisfactory reaction with the carbohydrate and a substantial but not excessive reaction with the cellulose.

Where the finish is imparted to the sized cloth by a friction glazer, the heat furnished by the glazer will ordinarily be sufficient to cure the resinous material, to which end it is desirable to give the material two or three passes through the glazer. This usually will introduce sufficient of a time element to secure the desired curing. In other cases, it is desirable to subject the glazed fabric to a short oven cure. We prefer to operate the heated roll of the glazer at a temperature of from about 300°F. to about
400°F., desirably at 350°F. The oven treatment is
8 preferably done at a temperature of 300°F. for a
period of 5 minutes. The temperature in the oven
may be higher or lower, providing the time the fabric remains in the oven is correspondingly reduced or increased.

In the case of schreinering, the fabric is passed only once through the schreiner after sizing, in which case the oven cure is conducted at a temperature of from 280°F. to 350°F. and for a period of from 8 to 2 minutes.

In calendering, substantially the same procedure as specified for glazing is employed.

Beetling is a cold process and, therefore, it is here necessary to accomplish the entire curing in the oven at a temperature of from approximately 280°F. to 350°F. for a period of from 10 to 3 minutes.

With respect to embossing, this also is a single pass procedure and, therefore, the curing must be done in whole or in part by subsequent oven treatment.

As a variation of the procedure above described, with
some of the mechanical finishing procedures, it is
9 possible to first impart the mechanical finish, then
apply the sizing, following the sizing and drying by
additional mechanical treatment. Superior results insofar as durability is concerned, may be obtained in this manner,

but the hand or feel of the fabric obtained is somewhat different under these circumstances.

We have obtained very good results with this process using embossing procedures, obtaining fabrics used primarily for book cloth.

In all cases the finished product has a finish which is, for all practical purposes, durable to water, washing with soap and dry cleaning, repeatedly, without substantial alteration of the finish.

While the invention has thus far been described in connection with fabrics, it is useful for other fibrous materials, such as paper, yarns, and the like.

The concentration of the carbohydrate (and, therefore, of the aldehyde) may be varied over wide limits, depending on such factors as the stiffness or hand desired, whether the goods are dress goods, curtain material, oilcloth, or the like. The aldehyde, as stated, is in excess of the theoretical amount required to react with the carbohydrate.

The following are typical of representative formulas used in obtaining the results above given. Some of these mixtures were applied by impregnation, some by coating, and others by printing.

> *A.* 8 lbs. white dextrine, 3 lbs. formaldehyde (37%), 1.5 lbs. ammonium thiocyanate; make water solution and heat, then cool and add .25 lbs. lecithin, 8.00 lbs. avitone A (a product of DuPont Co.); make up to 25 gallons.
>
> *B.* 8 lbs. white dextrine, 3 lbs. formaldehyde (37%), 1.5 lbs. ammonium thiocyanate; make water solution and heat, then cool and add .25 lbs. lecithin, 8.00 lbs. avitone A, 3.00 lbs. formaldehyde and make up to 25 gallons.
>
> *C.* 8 lbs. tapioca starch; boil up with water to make a smooth paste, add 3 lbs. formaldehyde, 1.5 lbs. ammonium thiocyanate; allow to react, then cool and add 8.00 lbs. cream softener, 4.00 lbs. formaldehyde, 1.00 lbs. ammonium thiocyanate; make up to 25 gallons.

D. 36.0 lbs. organdy gum C; heat to get a smooth paste with water, cool, add 18.0 lbs. formaldehyde (37%), 2.5 lbs. ammonium thiocyanate; water to make 25 gallons.

11 *E*. 8.00 lbs. tapioca starch, 16.0 lbs. organdy gum C; heat to get a smooth paste with water, cool, add 20.0 lbs. formaldehyde (37%), 4.0 lbs. glyoxal, 3.25 lbs. ammonium thiocyanate; water to make 25 gallons.

F. 20 parts gum tragacanth, 6 parts formaldehyde (37%), 4 parts carbowax 4000, 3 parts ammonium thiocyanate, 300 parts water.

G. 15 parts pectin, 6 parts formaldehyde (37%), 4 parts carbowax 4000, 3 parts ammonium thiocyanate, 280 parts water.

H. 20 parts karaya gum, 8 parts formaldehyde (37%), 4 parts carbowax 4000, 3 parts ammonium thiocyanate, 250 parts water.

I. 50 parts gum arabic, 25 parts formaldehyde (37%), 10 parts carbowax 4000, 4 parts ammonium thiocyanate, 450 parts water.

J. 40 parts methyl cellulose, 25 parts formaldehyde (37%), 10 parts carbowax 4000, 4 parts ammonium dihydrogen phosphate, 600 parts water.

K. 50 parts white dextrine, 25 parts formaldehyde (37%), 10 parts olein oil, 4 parts ammonium thiocyanate, 500 parts water.

12 *L*. 20 parts farina starch, 20 parts formaldehyde (37%), 10 parts cream softener, 3 parts ammonium thiocyanate, 400 parts water.

M. 50 parts white dextrine, 25 parts glyoxal, 10 parts carbowax 1500, 5 parts ammonium thiocyanate, 500 parts water.

N. 30 parts 3-A starch, 10 parts formaldehyde, 10 parts hexamethylene tetramine, 10 parts olein oil, 200 parts water.

The carbohydrate (one or more), aldehyde and catalyst may be mixed together and semi-reacted by heating the solution or dispersion of the ingredients for an appreciable time. This method is used especially when the carbohydrate constituent is a thick boiling starch. Examples A, B and C were prepared in this manner.

The carbohydrate may be first dissolved or dispersed in water by means of heat and the solution cooled partially or to room temperature and the aldehyde is added. The catalyst may be added during the solution of the carbohydrate or at any time thereafter. Examples D and E were prepared in this manner.

The carbohydrate may be dispersed in water and this dispersion applied to the fabric. Then the said fabric
13 is treated with the aldehyde. The catalyst must be
present in either the first or second step but may be present in both. Thus, in Example K the 50 parts of white dextrine and the 10 parts of olein oil are dispersed in 500 parts of water, the fabric is padded therewith, and then dried, after which it is treated with a solution of 25 parts of formaldehyde (37%) and 4 parts ammonium thiocyanate and 500 parts of water.

The aldehyde may be applied first to the fabric and the fabric afterwards treated with the carbohydrate dispersion. The catalyst must be present in one or the other of the applications but may be present in both. This method is not applicable to very volatile aldehydes such as formaldehyde. The following example is illustrative of this method of treatment:

A fabric was impregnated with a solution made up of 6 parts hexamethylamine tetramine, .25 parts mill ammonia (28%) and 200 parts water and then dried without excessive heating. This was followed by the application of a solution made up of: 10 parts of AAA Starch, 2 parts of ammonium thiocyanate and 200 parts water. The cloth was then partially dried and glazed three times, followed by the usual washing treatment for chintz and finally dried.

14 In the other examples of formulas given (F, G, H,
I, J, L, M, N), the carbohydrates were dispersed first in water and after obtaining a clear solution or smooth dis-

persion, the catalyst and aldehyde were added together with other desirable ingredients.

In some cases it is possible to produce the reaction product by the heat of the finishing operation and/or of the oven treatment, without objectionable loss of chemical through evaporation, particularly where the aldehyde is in a form less readily volatizable. For example, an aqueous solution or mixture of the carbohydrate may be applied, followed by the aldehyde, preferably in a not too volatile form, such as hexamethylene tetramine. This procedure may be followed especially if such a product as alkali soluble ethyl hydroxyl cellulose is used, in which case it is necessary to acidify and wash the cloth prior to the application of the aldehyde. Part or complete drying may or may not follow, the application of the carbohydrate depending upon the durability desired. If not dried, the durability is usually better, but the "hand" is firmer.

Where the order of treatment is reversed and the aldehyde applied, followed by the carbohydrate, in case drying is resorted to after the application of the aldehyde, care must be taken that the aldehyde is not lost by evaporation. Thus, by way of illustration, if the aldehyde is formaldehyde, a polymerization product of this compound, such as hexamethylene tetramine, a paraformaldehyde, in partial or complete substitution for formaldehyde, should be used.

Stated in another way, where the aldehyde or the particular form of aldehyde employed is such that objectionable loss of the chemical does not occur during the curing, curing may be relied upon to produce the reaction product of the aldehyde and the carbohydrate.

* * * * * * * * * *

(See original claims)

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[Portion of Plaintiff's Exhibit 2]

* * * * * * * * * *

28 AFFIDAVIT OF WILLIAM P. HALL

State of Pennsylvania, County of Philadelphia, ss:
William P. Hall, being duly sworn, deposes and says:

1) That he is one of the applicants in the above entitled application and is familiar with and understands the same and is also familiar with and understands the references cited and in particular der Horst, No. 2,099,765, and Lippert, No. 2,148,316;

2) That he is a graduate of The Johns Hopkins University with a degree of Ph.D.; that he is and has been engaged for the last eleven years in the textile industry, his duties relating to the chemical end thereof, inclusive of research
development and production work; that he is now and
29 has been for about the last seven years, Assistant
Chemical Director of Joseph Bancroft & Sons Co.,
Wilmington, Delaware, textile finishers, dyers and printers;

3) That in particular he is thoroughly familiar with and understands the processes for imparting mechanical finishes, in which materials forming polymerizable thermosetting resins are employed, and has operated such processes for many years;

4) That in all such processes, the resin-forming materials must be employed in an initial state of polymerization not beyond the "A" stage, i.e., they must be substantially water soluble and cannot be used in the "B" or polymerized stage; that in such processes the mechanical finish imparted by the finishing machine is obtained by the physical deformation of the fibers caused by the machine, which operates under pressure and heat; and that the durability of the mechanical finish thus imparted is obtained by the polymerization of the resin-forming materials, to wit, by the condensation of the resin on and in the fibers for which purpose heat is supplied; and that in the polymerization the molecule is made so large as to become water insoluble;

That with such materials drying to dampness is to prevent too rapid polymerization;

30 5) In contradistinction, in the present invention, the polysaccharide (starch) is already polymerized (with a molecule already of a size so great that it can hardly be said to penetrate within a fiber) and no polymerization of the carbohydrate units takes place during the heating; that polysaccharide carbohydrates, in contradistinction to thermo-setting resinous materials, tend to decompose in the presence of heat; that starch is water soluble although it is in the polymerized state; and that hence the fixing of the deformed fibers constituting the mechanical finish imparted by the finishing machine is accomplished by an entirely different mechanism;

6) That in the present invention, during the heating, aldehyde groups react with the OH groups of the already polymerized polysaccharide of which there are a vast number, and render the same non-swelling when subjected to subsequent treatment with water such as boiling soap solutions; that it is the presence of the OH groups in the polysaccharide molecule which renders the same water-absorptive and swelling; that when these hydroxyl groups have been destroyed by the aldehyde, which occurs in the presence of the heat, the swelling properties are likewise destroyed; and that in this process, drying to dampness
31 is to keep the carbohydrate soft so as to flow in the finishing machine treatment;

7) That friction glazing, schreinering, calendering and embossing are pressure mechanical finishing machines, operating under high pressures of the order of 10,000 to 50,000 p.s.i. bearing pressure; that the Rackel machine and the Foulard machine of der Horst are not pressure mechanical finishing machines; that the Rackel machine is only a sizing machine, i.e., a back-filler, which applies the sizing to one face only of the fabric; and that the Foulard finish is a soft, limpid finish, obtained by softening and rendering more flexible silk and cotton, and that a Foulard machine operates as a fuller to push yarns and fibers, as it were, endwise to loosen up the fibers and thus to increase softness

and flexibility, whereas a mechanical finish tends to stiffness and hardness.

8) That it is surprising and unexpected that the already polymerized, water soluble starch which is not thermosetting in itself and which to the contrary tends to break down in the presence of heat, can be effectively used to impart permanence to the mechanical finish by heating in accordance with the applicants' process; in other words it is
not to be expected that employing Lippert's steps
32 with the raw materials of this application would pro-
duce the desired results;

9) That, referring now to der Horst, No. 2,099,765, if the fabric be sized and dried, as he describes, and then passed through the finishing machine, the resultant finish is not durable for two reasons, the first of which is that the desired deformation of the fibers and the sizing material cannot then be obtained (in contradistinction, in the method of the application the sizing material, in the softened moist state, is caused to flow under the influence of the pressure of the finishing machine, causing deformation which becomes durable under the chemical alteration produced by the heat), and the second of which is that at the temperatures employed by der Horst which are well below those of the applicants', the carbohydrate is not rendered non-swelling as he, himself, recognizes when he acknowledges an appreciable amount of material is washed off;

10) That, still referring to der Horst, if his drying step were omitted it would be impossible to pass the fabric through the finishing machine with commercial results.

William P. Hall.

Sworn to and subscribed before me, a Notary Public, this 19th day of February, 1947. Edith Reeves, Notary Public. My Commission expires March 5, 1949. (Seal)

* * * * * * * * * *

[Defendant's Exhibit 1—Part 3]

* * * * * * * * * *

49 EXAMINER'S STATEMENT

Applicants appeal from the final rejection of claims 22-31, the only claims in the case, found immediately below. The amendments of February 24, 1947 and February 28, 1947 have been entered to place the application in better condition for appeal.

[For text of claims on appeal, see this Appendix, pp. 4 & 5]

* * * * * * * * * *

50 The alleged invention relates to a method for producing mechanical finishes such as friction glazing on textile fabric which will resist the action of water and resist repeated washings with no objectionable loss of finish. Applicants apply to a textile fabric a resinous product obtained by reacting a carbohydrate such as dextrine and an aldehyde (formaldehyde) usually in the presence of a catalyst. While the textile material is still damp, a mechanical finish is imparted to the textile material which at the same time cures the resinous material impregnated therein. Curing of the resinous material can also take place after the mechanical finish has been imparted to the fabric.

The references relied upon are:

Lippert	2,148,316	Feb. 21, 1939
Horst	2,099,765	Nov. 23, 1937

Claims 22-31 stand rejected as unpatentable over Horst in view of Lippert. The Horst patent discloses a process of imparting a durable finish to a textile fabric by sizing the material with a water solution containing a polysaccharide and formaldehyde, removing excess impregnant, imparting a finish to the fabric, and heating the fabric over drying cylinders heated (250°F) by means of steam
51 at two atmospheres pressure (page 2, Example 9).

Although applicants claim the use of a higher temperature than shown in Horst, the use of a higher temperature is not considered critical nor is the result different from that obtained by Horst. The use of a roller heated from 320°F to about 400°F in the polymerization of a sizing compound in situ is clearly disclosed in Lippert. To use the temperature disclosed in the Lippert process in the Horst process does not show invention since both processes are concerned with completing polymerization of a sizing composition in situ.

Claim 23 differs from claim 22 in that the mechanical finish is imparted prior to curing. Claim 24 differs from claim 22 in that curing is accomplished simultaneously. Example 6 of the Horst patent discloses treating the fabric in a finishing apparatus with subsequent heat treating at 212°F. In addition, Lippert shows oven treatment after glazing (page 2, column 1, lines 16-17). The step of simultaneously curing is shown in Example 5 of Horst wherein an ironing step is described.

Claim 25 differs from claim 22 in that an excess of aldehyde is used in the process. The examples shown in Horst set forth large proportions of formaldehyde which indicate an excess of formaldehyde. Furthermore, the proportions shown in Horst are not limited to stochiometric proportions of formaldehyde or to the use of insufficient formaldehyde.

Claim 26 differs from claim 22 in that preliminary reaction takes place from 190°F to 212°F. The Horst patent discloses a preliminary reaction and an elevated temperature. Nothing critical is seen in the temperature range disclosed in claim 26 since the result is one of degree only.

52 Claim 27 differs from claim 22 in that curing takes place at 350°F. The use of a high temperature in the curing process is anticipated by Lippert (320°F to 400°F).

Claim 28 differs from claim 22 in that a catalyst is claimed which provides a pH from 4 to 5. The pH described is one which is slightly acid. Reference to Example 11 of Horst discloses the use of ammonium sulphocyanide which is an acid salt and will provide an acid medium of pH less than 7.

Claims 29 and 30 differ from claim 22 in that the aldehyde is specific to formaldehyde and the catalyst ammonium thiocyanate. Formaldehyde is specifically disclosed in Horst which also shows the use of acid salts such as ammonium oxalate and ammonium sulphocyanide (Example 11).

Claim 31 differs from claim 22 in that the fabric is dried to dampness and the mechanical finish is imparted by friction glazing. Lippert discloses that 10% moisture is retained in the cloth prior to glazing (page 1, column 2, lines 37-39) and shows the use of friction glazing (page 1, column 2, lines 40-46).

The affidavit of William P. Hall has been carefully considered. However, it is not seen that the statements therein render the prior art less pertinent. The affidavit describes the chemical phenomena of the process in greater detail. However, of greater importance as to patentability, is the fact that the steps of the process as set forth in applicants' claims are clearly anticipated by the combined teachings of Horst and Lippert. The degree to which the aldehyde and polysaccharide are reacted before application to the textile
fabric does not lend patentability to the claims. The
53 decision In re Haller and Kappeler 481 O.G. 6, 1937
C.D. 281; 24 CCPa 887; 87F (2d) 520 is believed
significant.

For the above reasons it is believed that the final rejection should be sustained.

Respectfully submitted,

C. F. Krafft, Examiner, Division 38.

* * * * * * * * * *

[Defendant's Exhibit 1—Part 4]

* * * * * * * * * *

83 This is an appeal from the action of the Primary Examiner finally rejecting claims 22 to 31 inclusive. Claim 22 is reproduced as illustrative of the subject matter:

> 22. The process of imparting durable lustrous mechanical effects to cellulose and regenerated cellulose fibers and fabric, which comprises sizing the material with a water solution containing a polysaccharide carbohydrate and an aldehyde selected from the group consisting of formaldehyde, paraformaldehyde, glyoxal and acetaldol, drying the material to dampness, imparting a lustrous mechanical finish to the material by a pressure mechanical finishing machine, and curing the treated material by heating the material to from substantially 280° F. to substantially 400° F.

The references relied on are:

Horst et al	2,099,765	Nov. 23, 1937
Lippert	2,148,316	Feb. 21, 1939

The claims are directed to a method for imparting
84 a lustrous finish to textile fabrics of the type commonly known as "chintz," which is also durable to washing. This is accomplished, in accordance with the claimed method, by sizing the fabric with an aqueous solution containing starch and an aldehyde, with or without acid catalyst. After drying to dampness the material is subjected to a mechanical finish, i.e., to the treatment with heated pressure rolls, which, if carried out at sufficiently high temperature (280°-400° F.) simultaneously cures the sizing. If desired, the mechanical finish may be applied without curing, after which the material is subjected to oven curing.

The claims have been refused as lacking invention over Horst et al wherein a textile fabric is sized with an aqueous solution containing starch and formaldehyde which has first been allowed to stand at ordinary temperatures and an acid catalyst added prior to use. The fabric is impregnated with the solution containing an acid or acid reacting substance and then (as in example 9) passed through a Foulard finishing machine, after which it is led over drying cylinders heated by means of steam at two atmospheres (250°F).

The Examiner refers to Lippert as disclosing the use of finishing rollers heated to the higher temperatures as claimed by appellants, the position taken by the Examiner being that no invention would be involved in heating the sizing disclosed in Horst et al to the higher temperatures disclosed in Lippert.

Appellants contest this combination of the references, pointing out at great length the differences in the chemical nature of Lippert's ureaformaldehyde resin and starch-formaldehyde sizing, the urea-formaldehyde being
85 applied to the cloth as liquid impregnant, and then
polymerized, while starch is itself a polymeric substance.

It is further contended that, as to the reference Horst et al, there is disclosed no treatment of the fabric to impart a mechanical finish as claimed, nor the fixing of such a finish. Appellants state that Horst et al "apparently fully react starch and formaldehyde" and then applies this fully reacted product as a paste, and such a product cannot be further subjected to heating and mechanical finishing since it is not thermoplastic. Appellants indicate, as is stated in the brief (page 21) "that they may use the starch in partially reacted form . . . the reaction being completed by the high curing temperature of the finishing machine" citing page 12 line 17 of the specification.

We have carefully considered appellants' contentions in respect to the Horst et al patent, but we do not find that the reference excludes the reaction of the starch with formaldehyde in situ on the fabric. On page 1 of the patent lines 43 to 47, left column, Horst et al clearly state that the starch and formaldehyde are reacted at ordinary temperatures, the period of interaction and the nature of the starch being such that the starch "is still capable of yielding a paste" after said interaction is completed. The product so obtained is not considered as differing essentially from the partially reacted form employed by appellants. According to Horst et al the textile may be soaked with a bath containing such starch preparations in a "pasted state" and then in a further bath which is weakly acid and finally dried at elevated temperatures, for example 100° C (page 1, column 2, lines 16-22).

86 In example 6 of Horst et al as is pointed out by the Examiner in his Statement a starch formaldehyde mixture, held at ordinary temperatures for 24 hours after drying, is pasted with more starch and ammonium sulphocyanide, and the back side of carpet fabrics treated with the mass. The fabric is then passed through a Rachel machine and dried at 100°C.

This treatment is in essence, the application of a partially reacted starch formaldehyde mixture, containing an acid reacting substance, to a textile fabric followed by applying a desired mechanical finish to the fabric, thereafter setting the finish by heating.

While Horst et al do not disclose the setting of the starch formaldehyde reaction product by means of heated rolls it is not evident that this alone results in an inventive combination over Horst et al. The application of rolls for finishing to produce a lustrous finish is admittedly well known, and the Lippert patent cited by the Examiner discloses the combination of the treatment by heated rolls for setting an impregnant. We agree with the Examiner that the temperature of setting as set out in the claims, while higher than disclosed in Horst et al, is not critical and involves no invention.

The decision of the Examiner is affirmed.

In event of appeal attention is directed to *In re* Boyce, 32 C.C.P.A. 718; 144 Fed. (2d) 896; 1944 C.D. 609; 568 O.G. 568; 63 U.S.P.Q. 80, in regard to specifically including in the appeal notice all grounds of rejection in the Examiner's Statement not expressly overruled by the Board.

V. I. Richard, Examiner-in-Chief, E. W. Geniesse, Examiner-in-Chief, H. Surle, Examiner-in-Chief (Acting), Board of Appeals.

Synnestvedt & Lechner, 12 South 12th St., Philadelphia, Pa.

July 8, 1948

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[Portion of Plaintiffs' Exhibit 2]

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87 REQUEST FOR RECONSIDERATION

The Board is respectfully requested to reconsider its Opinion and allow the claims or send the case back to the Examiner for further prosecution.

In support thereof, it is submitted that the Board has not only fallen into errors of fact but has made fact findings contrary to the evidence in the case and has, in reality, based its conclusions on reasons not relied upon by the Examiner and therefore on reasons which the applicants have not heretofore been fairly called upon to meet.

In addition, the Board has apparently laid extreme emphasis on a point which is in reality wholly immaterial.

88 Moreover, as will further appear, either the applicants did not make their position clear or the Board has missed the significance of applicants' position.

Discussion

The Examiner based his rejection of the claims upon "the fact that the steps of the process as set forth in applicants' claims are clearly anticipated by the *combined* teachings of Horst and Lippert." (Page 4 of the Examiner's Statement, near the bottom.)

The Examiner clearly acknowledged thereby that neither reference taken alone was sufficient. Each lacks something or other.

Lippert, as pointed out in the Brief on Appeal, uses a wholly different material for fixing the finish obtained by the pressure mechanical finishing machine.

Der Horst lacks the imparting of a lustrous mechanical finish "by a *pressure* mechanical finishing machine".

However, the Board (in the second full paragraph of its Opinion, page 4) states that the "essence" of applicants' claimed process is disclosed in der Horst. To reach any such
conclusion, the Board must have concluded that der
89 Horst discloses a "*pressure* mechanical finishing
machine".

Thus the Board departed from the position taken by the Examiner, who has not asserted that der Horst discloses a "*pressure* mechanical finishing machine"; fell into an error of fact; and must not have given effect to the only evidence on the point in the case (Dr. Hall's Affidavit) that der Horst does *not* disclose "a pressure mechanical finishing machine", and the Rackel and Foulard machines are not pressure mechanical finishing machines.

The mechanical finishes listed in the specification are glazing (by a friction glazer), schreinering, calendering (non-friction glazing), beetling, and embossing (page 2, second paragraph).

All of these finishes are obtained by calender rolls, i.e., "calenders" between which the fabric passes and which are pressed together at pressure ranging from 10,000 lbs. to 50,000 lbs. per square inch bearing pressure, or, translated into lineal pressure, with 36" width of fabric, of almost 300 lbs. to 1111 lbs. per lineal inch on the fabric as it passes between the calender rolls. (Bear in mind that with rolls or calenders there is only line-to-line contact and hence the
pressure per lineal inch is enormous.)

90 Under such enormous pressures, not only the

threads but the fibers of which the threads are constituted, are flattened. This distortion or flattening constitutes the mechanical finish which has to be fixed so as to render it durable to repeated and repeated washings. (Dr. Hall's Affidavit, page 6, near the top.)

Der Horst, in Example 6, refers to a Rackel machine and in Example 9 to a Foulard machine. These are the only machines referred to by Der Horst. Neither of these is a pressure mechanical finishing machine. The Examiner does not contend that the Rackel machine or the Foulard machine is a *pressure* mechanical finishing machine.

The Rackel machine is only a *sizing* machine, i.e., a machine for applying a solution to one face only of a piece of fabric (a back-filler).

No pressure is involved. (See Dr. Hall's Affidavit.)

A back filler is shown in the accompanying sketch.

A Foulard machine, instead of exerting pressure on the fabric to flatten out the yarns and the fibers, loosens up the fibers endwise to make a *soft, limpid finish* in substantially the same way that wool yarns have the fibers separated or loosened up. (See Dr. Hall's Affidavit.)

(To the contrary, a pressure mechanical finishing machine makes the fabric relatively *stiff* by flattening the yarns and the fibers constituting the same.)

91 Thus, all that der Horst shows is a method for rendering water soluble starch, insoluble; and fails utterly to disclose the "pressure mechanical finishing machines" here involved.

From this viewpoint it is utterly immaterial whether der Horst's starch is fully reacted at the time of application to the fabric or is only partially reacted and then reacted to completion in situ on the fabric.

The Board states that Der Horst does not exclude completion of reaction in situ on the fabric, but, as stated, this is wholly immaterial.

The question here presented is this: Because it is known

how to insolubilize starch, does it obviously follow that one can *fix* and render durable, a pressure mechanical finish by insolubilized starch? Lippert, to be sure, teaches fixing such a mechanical finish with a wholly different material, an unpolymerized material, whose molecule is so small that it cannot only be on but within the fibers which constitute the yarn. Among other things, as has been pointed out in the main brief, starch is already polymerized and its molecule is so large that it will not enter within the fibers but only remain on the exterior. For this and other reasons pointed out in the brief, Lippert's material and applicants' material are wholly different. It does not at all fol-
92 low that because someone know how to insolubilize starch, insolubilized starch could be used to *fix* a *pressure* mechanical finish in place of the wholly different material of Lippert, particularly where the mechanics of the fixing are so different as also pointed out in the Brief.

If the Board feels that the phrase, "a *pressure* mechanical finishing machine", does not adequately distinguish from the Rackel machine and the Foulard machine of Der Horst, then it is suggested that the word "calender" be substituted for "machine" and the case sent back for allowance under Rule 139.

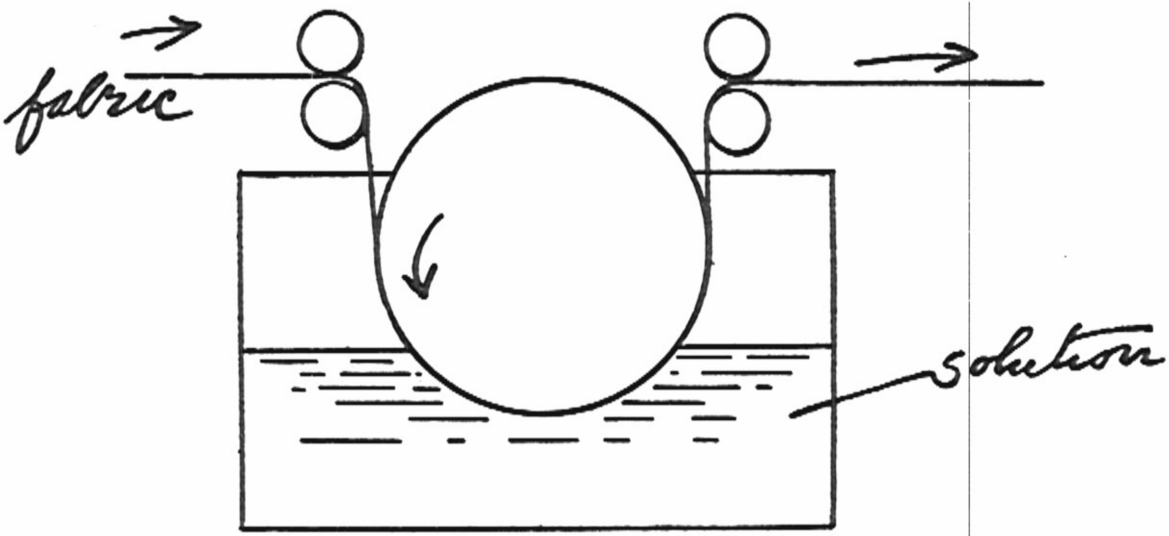
All pressure mechanical finishing machines are calenders.

How far the Board has gone astray in assuming that because Der Horst teaches how to insolubilize starch, therefore there is no invention in discovering that insolubilized starch may be used to *fix* a *pressure* mechanical finish, is further illustrated by the fact that in Examples 5, 6 and 9 of Der Horst, the only ones which in any wise mention a mechanical implement, the fabric is subjected to the same in the wet state, in which state, as applicants are prepared to show, the fabric cannot be passed through a friction calender or glazer. Note that in all of the claims the step of drying to dampness (i.e., to about 10% moisture) is
93 called for. This is an essential step not taught any-

where in Der Horst for, as stated, wherever he mentions any kind of a mechanical implement, the fabric is subjected thereto in the wet state. This essential limitation seems to be completely ignored by the Board in its assumption that there is no invention in applicants' process over Der Horst. Drying to dampness in applicants' case performs different functions than it does in Lippert. (See Brief.)

Respectfully submitted, Florence M. Ford, William P. Hall, by Synnestvedt & Lechner, Attorneys. Philadelphia, Pa., July 27, 1948.

94 Mail Division, July 28, 1948, U. S. Patent Office.
Board of Appeals, July 30, 1948, U. S. Patent Office.



fabric sized on the face only

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[Defendant's Exhibit 1—Part 5]

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95 ON REQUEST FOR RECONSIDERATION

Appellants have filed a request that we reconsider our decision of July 8, 1948 and allow the claims or return the case to the Examiner for further prosecution.

Appellants' request appears to be based upon an interpretation of the second full paragraph on page 4 of our decision, from which they conclude that it was our understanding that the reference der Horst discloses a "*pressure* mechanical finishing machine".

We find no basis for appellants' conclusions. If
96 any question was raised in appellants' minds as to
the intended meaning of the term "a desired mechanical finish" (interpreted by appellants as a "*pressure* mechanical finishing machine") the next paragraph of the decision would be a clear indication that der Horst was *not* considered as disclosing a "*pressure* mechanical finishing machine" and that Lippert is relied upon as disclosing this feature.

The remainder of the request is merely a reiteration of appellants' arguments which were previously presented in the brief and have been fully considered by us in reaching our previous opinion.

The request for reconsideration is granted to the extent indicated, but is denied with respect to making any change in our previous decision.

V. I. Richard, Examiner-in-Chief, E. W. Geniesse, Examiner-in-Chief, H. Surle, Examiner-in-Chief (Acting), Board of Appeals.

November 9, 1948.

Messrs. Synnestvedt & Lechner, 12 South 12th Street, Philadelphia, Penn.

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[Defendant's Exhibit 1—Part 1]

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1 Patended Nov. 23, 1937 2,099,765

UNITED STATES PATENT OFFICE

2,099,765

Finishing Textiles

Horst Dietrich Freiherr von der Horst, Leuna, and Ferdinand Muenz and Adolf Vogt, Frankfort-on-the-Main, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.

No Drawing. Application December 27, 1933, Serial No. 704,144. In Germany December 29, 1932.

9 Claims. (Cl. 91—70)

The present invention relates to a process of finishing textiles and sizing materials suitable for carrying out the said process.

We have found that textiles may be finished in a very advantageous manner by treating them in an aqueous medium with a compound capable of reacting as an aldehyde and starch in a form capable of yielding a paste, preferably in the presence of acid-reacting substances. The most suitable compounds capable of reacting as an aldehyde are formaldehyde and substances yielding the same, such as hexamethylenetetramine. The process may be carried out by drying starch in the presence of aldehydes such as formaldehyde or substances splitting off aldehydes such as hexamethylenetetramine on the fibre in the presence of acid reacting compounds such as acids, acid salts and substances splitting off acids. This method of carrying out the invention is of great industrial value because the working up and drying of the textiles may be carried out in the usual manner without any special precautions. Another very advantageous method of performing the process according to the present invention consists in treating the fibres with reaction products of formaldehyde and starch which are still capable of yielding a paste and subsequently drying at elevated temperatures. The treatment of the textiles with the said product is preferably carried out in the presence of acid reacting substances advantageously of weakly acid-reacting substances, namely acids, substances which are not acids themselves but have an acid reaction and substances splitting acids. Of course the presence of such acid substances as would injure the fibres, for example by an oxidizing action, is avoided.

The starch preparations suitable for the said treatment may be obtained by treating starch of any origin, for example potato starch, wheat starch, rice starch, tapioca starch and the like with formaldehyde, preferably at ordinary temperature. The period of the interaction of formaldehyde and starch depends on the special kind of starch used; it is so selected that the starch is still capable of yielding a paste after the said interaction is completed. Instead of formaldehyde itself substances yielding formaldehyde may be used, for example paraformaldehyde, condensation products of formaldehyde with acetone and the like. After the reaction between formaldehyde and starch the reaction product formed is dried at ordinary or slightly elevated temperature, if desired, under decreased pressure. The product thus obtained is treated at elevated temperature before its employment for finishing textiles with water while adding weakly acid-reacting substances, for example weak acids or acid reacting salts such as phosphoric acid, acetic acid, succinic acid, adipinic acid, benzoic acid, phthalic acid, mono sodium phosphate, sodium bisulphate, sodium sulphocyanide, the ammonium salt of adipinic acid and the like. Acid reacting substances injuring the fibres such as concentrated hydrochloric acid or acids having an oxidizing reaction are avoided.

According to the present invention textiles such as calico fabrics, bloom fabrics, linen, especially buckram, shirtings, collars and the like or animal fibres may be finished industrially in a simple manner. For example the said textiles are soaked with a bath containing starch preparations obtained as described above in a pasted state and in suitable proportions, the said textiles then being handled in a further bath which is weakly acid and finally dried at an elevated temperature, for example at about 100°C. The finishing of the textiles may also be carried out in one bath; in this case the acids or acid reacting substances mentioned are added to the starch before or after the treatment with formaldehyde.

In many cases it is advantageous to use further finishing materials besides the products of the interaction of starch with formaldehyde. An especially valuable finishing material is obtained by incorporating the starch treated with formaldehyde in the manner set forth above with ordinary starch, allowing the mixture to stand for a prolonged time and then using it for finishing purposes. Further additions suitable for finishing processes may be added to the baths, for example fillers, such as kaoline, pipe clay, China clay, alkali metal silicates, magnesium sulphate and the like; softening agents, such as soaps, Turkey red oils, waxes, for example bees wax, Japan wax, paraffin and products obtainable by acting with alkylene oxides and similarly reacting compounds on organic compounds containing hydroxyl, amino or carboxylic acid groups, wetting agents and agents causing a high gloss of the textiles may be employed in addition to the substances mentioned above.

By working in the said manner finishings are obtained which are very stable to washing; textiles finished in the said manner give off only a small part of the finishing material applied thereto according to the present invention even after repeated washing with soap and soda.

The finished fibres obtainable according to the present invention may contain considerable amounts of the finishing material, for example between 5 and 20 per cent of the fibre weight, preferably between 10 and 15 per cent.

The following examples will further illustrate how the invention may be carried out in practice, but the invention is not restricted to these examples. The parts are by weight.

Example 1

500 parts of potato starch are treated for 7 days at ordinary temperature with 330 parts of a 30 per cent formaldehyde solution and subsequently dried at 45° C. in vacuo. 5 parts of the starch thus treated are pasted by means of 0.3 part of ammonium sulphocyanide in 100 parts of water.

Calico fabric is impregnated with the mass obtained in the usual manner and subsequently dried for 30 minutes at 100° C. The fabric obtained has a finishing stable to washing; only 16 per cent of the finishing material applied to the fibre is removed therefrom by washing twice with soap and sodium carbonate.

Example 2

1 part of concentrated hydrochloric acid and 5.7 parts of potato starch are introduced while stirring at 90° C. into 5.7 parts of a water-soluble condensation product obtainable from 1 molecular proportion of acetone and 9.7 molecular proportions of formaldehyde in alkaline solution. The mixture is allowed to stand at the said temperature until a clear solution is formed. The condensation product of starch and formaldehyde thus obtained is neutralized by means of sodium acetate and 3 parts thereof are pasted together with 5 parts of ordinary potato starch and 0.3 part of ammonium sulphocyanide in 100 parts of water.

A calico fabric is treated with the finishing mass thus obtained and dried for 30 minutes at 100° C. whereby a material is obtained the finishing of which is very stable to repeated washing with soap and soda.

Example 3

5 parts of potato starch, 1.5 parts of a 30 per cent formaldehyde solution and 100 parts of water are stirred together for 24 hours at ordinary temperature, the starch thus treated being pasted subsequently with the addition of 1.7 parts of acetic acid at 80° C. A mass is thus obtained which is directly suitable for the production of finishings on cotton and linen fabrics which are fast to washing. After washing such fabrics twice with a soap and sodium carbonate 85 per cent of the finishing material applied to the fibre is still present thereon.

Example 4

5 parts of rice starch, 1.5 parts of a 30 per cent formaldehyde solution and 100 parts of water are caused to react with one another at ordinary temperature for 24 hours. The starch is then pasted by means of 1.7 parts of malonic acid while warming at 80° C. A mass is thus obtained which is very suitable for producing finishings for example on linen or bloom fabrics which are stable to washing.

Example 5

50 parts of the product of the reaction of formaldehyde and starch obtained according to Example 4 are suspended in 1000 parts of water, 2 parts of ammonium sulphocyanide being added thereto. Collars are treated with the said suspension while using a bath proportion of 1:10 in a rolling keg until the major part of the starch is absorbed. The material is then slung off and the collars are ironed in the usual manner.

Example 6

125 parts of potato starch are treated for 24 hours at ordinary temperature with 75 parts of a 30 per cent formaldehyde solution and subsequently dried at 50° C. under de-

creased pressure. 8 parts of the product thus obtained are pasted together with 42 parts of potato starch by means of 1 part of ammonium sulphocyanide in 1000 parts of water at 60° C. The back side of carpet fabrics are treated with the mass obtained in a finishing apparatus for example in a "Rackel-machine" and dried for half an hour at about 100° C. By this treatment the fabric becomes mechanically stable and fast to washing and water.

Example 7

500 parts of potato meal are treated with 330 parts of a 30 per cent formaldehyde solution for 5 days at ordinary temperature and then dried in vacuo at 45° C. and ground. One part of this preparation is mixed with 2 parts of potato meal and the mixture is allowed to stand for 5 or more days. The product thus obtained is readily soluble in water to form a paste and is suitable for finishing fabrics such as linen or cotton in the presence of acid reacting substances such as ammonium oxalate, the finishings obtained being very fast to washing.

Example 8

10 parts of the mixture of untreated potato meal and of potato meal treated with formaldehyde as described in Example 7 are dissolved in 1000 parts of water and 2 parts of ammonium oxalate and 1 part of titanium dioxide are added thereto. Artificial silk fabrics are handled in the bath thus obtained in the usual manner at between 60° and 70° C.; the fabric is then squeezed and dried for about 15 minutes at 100° C. By the said treatment the artificial silk fabric acquires a full, strong touch similar to that of silk taffeta. The finishing obtained is very fast to washing.

Example 9

1 part of the reaction product of formaldehyde and potato starch obtained according to Example 6 is thoroughly mixed

with 2 parts of ordinary potato starch and the mixture is allowed to stand for one week. A bath is prepared containing per litre of water 75 grams of the starch preparation prepared as described above, 1.5 grams of ammonium oxalate and 10 cubic centimetres of a 30 per cent formaldehyde solution. Calico fabric is continuously impregnated at about 70° C. with the said bath in a finishing machine. Then the fabric passes through a so-called Foulard finishing machine and is led for four times over drying cylinders heated by means of steam having a pressure of two atmospheres and dried. A material is thus obtained having a finishing very stable to washing. Even after washing the fabric three times with soap and soda still 81.6 per cent of the finishing mass is present on the fabric.

Example 10

A mixture of 100 parts of potato starch, 15 parts of a 30 per cent formaldehyde and 0.5 part of oxalic acid are pasted
by heating in aqueous solution. Calico fabric is
3 treated in the bath thus obtained and dried in the
warm. The finishing thus produced is stable even to repeated intense washing.

Example 11

100 parts of soluble starch are pasted by means of 4 parts of ammonium oxalate and 7 parts of para-formaldehyde in aqueous solution and cotton satin is impregnated with the finishing mass thus produced. The finishing is not injured by the usual washing treatment. Instead of ammonium oxalate other salts such as ammonium chloride, ammonium sulphocyanide and the like may be used.

Example 12

50 parts of soluble starch and 50 parts of potato starch are pasted by heating in an aqueous solution and 10 parts

of hexamethylenetetramine and 1 part of oxalic acid are added to the paste. Cotton fabric treated with the said mass acquires a finishing stable even to repeated washing treatments.

What we claim is:—

1. The process of finishing organic textiles which consists in treating them in an aqueous medium with starch in a form capable of yielding a paste and with a substance selected from the class consisting of formaldehyde and compounds yielding formaldehyde under the conditions obtaining and reacting with starch in the warm, and drying the said textiles in the warm while adding an acid-reacting substance.

2. The process of finishing organic textiles which consists in treating them in an aqueous medium with starch in a form capable of yielding a paste and with a substance selected from the class consisting of formaldehyde and compounds yielding formaldehyde under the conditions obtaining and reacting with starch in the warm, and drying the said textiles in the warm while adding a weakly acid-reacting substance.

3. The process of finishing organic textiles which comprises treating starch with formaldehyde and an acid-reacting substance to give a product still capable of yielding a paste and treating the said textiles in an aqueous medium with the said product and drying the said textiles in the warm.

4. The process of finishing organic textiles which comprises treating starch with formaldehyde and a weakly acid reacting substance to give a product still capable of yielding a paste and treating the said textiles in an aqueous medium with the said product and drying the said textiles in the warm.

5. In the process of finishing organic textiles by treat-

ment with a paste obtained by the steps which comprise treating starch with a substance selected from the group consisting of formaldehyde and substances which yield formaldehyde under the conditions obtaining and treating the resultant reaction product with an acid reacting substance, water and heat to convert the treated starch particles into a paste.

6. In the process of finishing organic textiles by treatment with a paste obtained by the steps which comprise treating starch at ordinary temperature for several days with a substance selected from the group consisting of formaldehyde and substances which yield formaldehyde under the conditions obtaining, forming a water suspension of the treated starch particles, adding an acid reacting substance thereto and heating the suspension in order to form a paste.

7. In the process of finishing organic textiles the steps which comprise treating starch with a substance selected from the group consisting of formaldehyde and substances which yield formaldehyde under the conditions obtaining, forming a water suspension of the treated starch particles, applying this suspension to an organic textile fabric, treating the suspension in contact with said fabric with an acid reacting substance and drying said treated fabric at a temperature of approximately 100° C.

8. In the process of finishing organic textiles the steps which comprise treating starch with a substance selected from the group consisting of formaldehyde and substances which yield formaldehyde under conditions obtaining, forming a water suspension of the treated starch, adding an acid reacting substance, heating the suspension to form a paste, applying the paste to an organic textile fabric and drying the same at a temperature of approximately 100° C.

9. Water-soluble starch pastes obtained by reacting starch with a substance selected from the group consisting

of formaldehyde and substances which yield formaldehyde under the conditions obtaining, to the point where a product is obtained which can be pasted with water in the presence of a weakly acid reacting substance, and pasting said product by treatment in water in contact with said substance.

Horst Dietrich Freiherr von der Horst, Ferdinand Muenz, Adolf Vogt.

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[Defendant's Exhibit 1—Part 2]

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1 Patented Feb. 21, 1939 2,148,316

UNITED STATES PATENT OFFICE

2,148,316

Process for Finishing Chintz

Arnold Leroy Lippert, Wilmington, Del., assignor to Joseph Bancroft & Sons Co., Wilmington, Del., a corporation of Delaware.

No Drawing. Application November 26, 1937, Serial No. 176,635.

4 Claims. (Cl. 91—70)

This invention relates to chintz and it has for its primary object an improved process for finishing chintz, providing a surface which will retain its lustre even after repeated launderings, is spot proof, appreciably fire resistant, and has some degree of flexibility and foldability.

The present application is a continuation in part of my copending application, Serial No. 136,525, filed April 13, 1937, Patent 2,103,293.

In said prior application I disclosed use of the resin, urea formaldehyde, for the above purpose, preferably in the presence of a protein coagulatable by heat, such as albumin or wheat gluten, and less desirably, casein.

While use of the urea formaldehyde alone does not make possible tearing of the material quite as straight from selvedge to selvedge as when combining the formaldehyde with a coagulatable protein, still I have found that proper handling of the material when using urea formaldehyde alone affords a finish which is highly satisfactory for many purposes and from many standpoints, such as the retention of lustre even after repeated launderings, and spot and fire proof characteristics.

If setting of the urea formaldehyde is effected simultaneously with glazing, as by passing the cloth through a heated glazer, the finish is highly glossy, and if the cloth be passed through a calender using high pressure and heat, the finish is less glossy.

The urea formaldehyde is desirably employed in aqueous solution in a range from about 10% to about 30% by weight. Preferably, however, the urea formaldehyde is kept within from about 15% to about 20%. This is of importance, as are also the manipulative steps hereinafter described, in providing the best type of finish.

With reference to this matter I am aware that formaldehyde resins of various types have been used in the treatment of cloth for other purposes but in such cases the handling of the material or the concentration of urea formaldehyde, or both, have been such as to produce effects entirely different from the chintz finish of this invention.

I am further aware that other resins, such as natural water soluble resins and water soluble or emulsifiable synthetic resins (for example phenol resin and acrylic resin) have been used heretofore in the treatment of cloth for various purposes. These, however, cannot be effectively used for the purposes of this invention. Some of them are incapable of withstanding the heat and break down, and with others the finish is unsatisfactory because they are water soluble after polymerization, or for other reasons.

However, the particular resin, urea formaldehyde, when employed in the percentage range and in accordance with the method hereinafter set out, is effective to produce the desired finish. This particular resin is substantially colorless and while its components are water soluble, in the polymerized state it is insoluble in water and not even attacked in a boiling soap solution. This resin, furthermore, is thermo-plastic before heating.

In carrying out the invention the solution of urea formaldehyde is prepared in the cold. Preferably the urea formaldehyde is first dissolved in water, and two additional ingredients are added, first, a catalyst, such as an acid salt (for example, ammonium phosphate) and second, a softening agent, such as ethyl cellulose.

As an example of a solution which has given highly satisfactory results I call attention to the following: urea formaldehyde 12½ pounds, ammonium phosphate 1¼ pounds, ethyl cellulose 1½ pounds, and sufficient water to make one hundred (100) pounds.

The cloth is subjected to the solution for a period of time merely sufficient to thoroughly impregnate. Application of the solution or impregnation of the cloth may be accomplished in various ways such, for example, as by the use of padder rolls, the lower one of which dips into the solution.

Following the above, the cloth is dried, preferably at a temperature of from about 150° to about 200° F. and in any event below the temperature at which the urea formaldehyde would be appreciably polymerized. Desirably, the drying is carried out in a manner to retain about 10% moisture in the cloth.

After impregnation and drying of the cloth, the cloth is preferably subjected to either one of two treatments adapted simultaneously to glaze and apply heat. The glazing may be effected either by pressure or roll slippage or both and the temperature employed is preferably upwards of about 320° F.

For a highly glossy finish, the impregnated cloth, after
drying on a frame, is run through a glazer of generally
usual construction and in which the upper roll is preferably
made of steel and is heated to a temperature of from about
320°F. to about 400° F., the middle roll being the usual
husk roll and the bottom roll being made of metal. The
middle and bottom rolls are not directly heated and
2 only become warm to the extent that heat is absorbed
from the top roll. In this glazer, the top roll operates
at a peripheral speed higher than that of the husk roll.

If a less highly glossy finish is desired, the impregnated cloth, after drying on a frame, is run through a calender in which the rolls revolve at exactly the same speed. The cloth may here be given two nips, and may be run once or several times. Here the temperature should preferably be at least 400° F. and the pressure should preferably be at least five (5) tons per square inch, and desirably substantially above this figure.

In both cases the resin is set (polymerized) by the heat and in both cases glazing is accomplished simultaneously with setting.

In the case of treatment in the glazer oven treatment may follow to insure setting.

In describing the invention I have referred to chintz, but it is to be understood that the invention is applicable to other mechanically lustrous products.

The finish imparted in accordance with the invention is relatively permanent and the color and pattern, if any, remain substantially unaffected by the treatment.

I claim:

1. The process of imparting a permanent lustrous finish to chintz which comprises subjecting the fabric to an aqueous solution of urea formaldehyde having a concentra-

tion of substantially 15% to substantially 20% urea formaldehyde, drying the fabric to a moist condition at a temperature below that at which the urea formaldehyde would be polymerized, and glazing the fabric in the presence of sufficient heat to set the urea formaldehyde, whereby the imparting of the finish and the setting of the resin are accomplished simultaneously.

2. The process of imparting a permanent lustrous finish to chintz which comprises subjecting the fabric to an aqueous solution of urea formaldehyde having a concentration of substantially 15% to substantially 20% urea formaldehyde, drying the fabric to a moist condition at a temperature below that at which the urea formaldehyde would be polymerized, and subjecting the fabric to the action of a glazer heated to a temperature between substantially 320° F. and 400° F. whereby simultaneously to set the resin and glaze the fabric.

3. The process of imparting a permanent lustrous finish to chintz which comprises subjecting the fabric to an aqueous solution of urea formaldehyde having a concentration of substantially 15% to substantially 20% urea formaldehyde, drying the fabric to a moist condition at a temperature below that at which the urea formaldehyde would be polymerized, and subjecting the fabric to the action of a calender exerting a pressure upwards of substantially five (5) tons per square inch in the presence of heat sufficient to set the resin, whereby the finish and the setting of the resin are accomplished simultaneously.

4. The process of imparting a permanent lustrous finish to chintz which comprises subjecting the fabric to an aqueous solution of urea formaldehyde having a concentration of substantially 10% to substantially 30% urea formaldehyde, drying the fabric to a moist condition at a temperature below that at which the urea formaldehyde would be polymerized, and mechanically imparting the desired finish

in the presence of heat sufficient to set the resin, whereby the imparting of the finish and the setting of the resin are accomplished simultaneously.

Arnold L. Lippert.

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[Defendant's Exhibit No. 2]

* * * * * * * * * *

Filed Jan. 22, 1951. Harry M. Hull, Clerk

The Chemistry of Synthetic Resins, by Carleton Ellis, Industrial Research Chemist. Library. Mar. 30, 1936. U. S. Patent Office. Volume I. Book Department, Reinhold Publishing Corporation, 330 West Forty-second Street, New York, U. S. A. 1935.

659 fluxing, and an oil, which on continued heating forms a resin fusing at 50°C., separates. Organic solvents may replace water as the reaction medium. Benzaldehyde and di-o-tolyl-thiourea give a stable, whitish reaction product (m.p. 160-177°C.) that is soluble in ether, alcohol, benzene, chloroform, acetone and carbon disulphide, but not in water. A product [51] of viscous, or resinous, character may be prepared by heating ethylene or butylene glycol with thiourea. The latter is then boiled with formaldehyde under reflux. The thiourea can be replaced wholly or in part by urea, and other agents such as acetylaniline, cyclohexanone, benzylglycol and crotonaldehyde used instead of formaldehyde.

Thiocyanate Compositions

As stated in the section on the production of thiourea, ammonium thiocyanate rearranges under the influence of heat to form thiourea. The conversion, however, is not complete; and, at 170°C., equilibrium is reached in about 1 hour, giving a mixture containing 25 per cent of thiourea.[52] Several investigators have prepared resins directly from formaldehyde and ammonium thiocyanate, others have used thiocyanates in conjunction with urea- or thiourea-formaldehyde condensations.

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[51] M. Paquin, U. S. P. 1,986,067, Jan. 1, 1935, to I. G. Farbenind. A.-G.; *Chem. Abs.*, 1935, 29, 1180.

Ammonium thiocyanate combines with formaldehyde in concentrated aqueous solution in equimolecular proportions without production of carbon dioxide. The condensation product can combine with further quantities of formaldehyde, forming bodies which, however, are less stable and readily part with some formaldehyde. The products are amorphous yellow compounds without definite melting points and are practically insoluble except in strong acids and strong alkalies, which presumably decompose them into their components.[53]

Experiments conducted in the author's laboratory with ammonium thiocyanate and formaldehyde indicated a harder resin could be obtained by using formaldehyde in excess of equimolecular proportions. Ammonium thiocyanate was dissolved in the minimum amount of water required to put it into solution and admixed with aqueous 40 per cent formaldehyde solution, using equimolecular proportions. The mixture was heated to about 50°C. and the yellow solution became turbid. Then, a yellow resin precipitated. Water was poured off and the product was dried at 110°C. for several hours. When hot it was a yellow viscous liquid which solidified on cooling to an opaque light yellow mass. It was brittle and possessed a disagreeable odor. The resin was insoluble in alcohol, benzol, acetone and mixtures of these, either hot or cold. It was also insoluble in water. In aniline and phenol the resin dissolved and could be precipitated by adding alcohol or benzol. When two molecular proportions of formaldehyde were used the reaction progressed spontaneously after being started by gentle heating. The conversion proceeded with rising temperature and a hard amorphous precipitate formed and settled. This was collected and dried. It was found to be soluble in cresol on slight heating although there were some signs of decomposition. The odor of both of these resins when heated is very disagreeable.

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[52] J. E. Reynolds, *Ann.*, 1896, 150, 224. J. E. Reynolds and E. A. Werner, *J.C.S.*, 1903, 83, 1. A. Findlay, *ibid.*, 1904, 85, 403.

[53] Schmerda, *Z. angew. Chem.*, 1917, 30, 176; *J.S.C.I.*, 1917, 36, 942.

Jacobson [54] prepared an acetone-soluble product that was
compatible with nitrocellulose by heating ammonium
660 thiocyanate and formaldehyde. A solution contain-
ing 60 g. of ammonium thiocyanate, 360 g. of 37 per cent formalin and 15 cc. of 10 per cent hydrochloric acid is refluxed for 1-2 hours and then concentrated to about 145 g. A yellowish syrup is formed, insoluble in water and alcohol, but soluble in acetone. The acetone-soluble material may be incorporated with nitrocellulose to form coating compositions, or it may be rendered insoluble by heating at 100-110°C. for 6-8 hours. A composition containing casein, ammonium thiocyanate and paraformaldehyde was used by Pierson [55] as an adhesive in wood-working.

On refluxing 1 mol of ammonium thiocyanate with 1.5-2 mols of aqueous formaldehyde, a resin is formed that may be dried, powdered and molded.[56] The excess of formaldehyde is condensed with urea, thiourea or resorcinol, added just before the molding operation; and an alkyd resin is added as a plasticizer. Free sulphur usually separates in the initial condensation, but this is allowed to remain and functions as a filler. The molding powder is stable and can be stored.

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[54] R. A. Jacobson, U. S. P. 1,945,315, Jan. 30, 1934, to E. I. du Pont de Nemours & Co.; *Chem. Abs.*, 1934, 28, 2480. See also British P. 348,420, 1929, to Imperial Chem. Ind., Ltd.; *Chem. Abs.*, 1932, 26, 2070. L. H. Englund (U. S. P. 1,926,766, Sept. 12, 1933, to Victor Chemical Works; *Chem. Abs.*, 1933, 27, 5712) used ammonium thiocyanate in coating compositions designed to prevent the rusting of metal surfaces. E. Söderbäck (*Ann.*, 1928, 465, 184; *Brit. Chem. Abs.* A, 1928, 1229) found that an aqueous solution of sodium hydroxytetrathiocyanate gels even at a 0.02 molar concentration.

[55] G. G. Pierson, U. S. P. 1,964,960, July 3, 1934, to Perkins Glue Co.; *Chem. Abs.*, 1934, 28, 5192.

[56] A. M. Howald, U. S. P. 1,910,338, May 23, 1933, to Toledo Synthetic Products, Inc.; *Chem. Abs.*, 1933, 27, 4110.

Gams and Widmer [57] prepared a resin solution by boiling, in a neutral medium, 600 parts by weight (1 mol) of urea with 1500 parts by volume (2 mols) of 40 per cent formalin. To 200 parts of this solution, 30 parts by volume of a 10 per cent ammonium thiocyanate solution are added, and the mixture is poured into molds. After a few minutes the mass gelatinizes and hardens to a snow-white product (sp. gr. 0.8-0.9) on standing. Cellulosic textiles may be impregnated with soluble condensation products of formaldehyde and ammonium thiocyanate or ammonium sulphide in the presence of urea.[58] The treated material is dried and heated to complete the polymerization of the impregnant.

The addition of metal thiocyanates to urea-formaldehyde molding compositions is said to promote polymerization in the hot-press and improve the moldings.[59] Urea, aluminum thiocyanate and formaldehyde are heated together in the presence of an alkali, giving a mucilaginous precipitate. The incorporation of the condensation product of a metallic thiocyanate and formaldehyde with a urea-aldehyde reaction mixture has also been used in preparing a molding resin.[60] If acid salts are added to an evaporated reaction product of calcium thiocyanate, thiourea and formaldehyde, a yellow resin is precipitated.

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[57] A. Gams and G. Widmer, U. S. P. 1,831,706, Nov. 10, 1931, to Soc. anon. pour l'ind. chim. à Bâle; *Chem. Abs.*, 1932, 26, 815.

[58] French P. 753,559, 1933, to Résines et vernis artificiels; *Chem. Abs.*, 1934, 28, 1202. British P. 424,535, 1934; *Brit. Chem. Abs.* B, 1935, 450.

[59] British P. 364,069, 1929, to Pfenning-Schumacher-Werke G.m.b.H.; *Chem. Abs.*, 1933, 27, 1724.

[60] British P. 364,068, 1929, to Pfenning-Schumacher-Werke G.m.b.H.; *Chem. Abs.*, 1933, 27, 1724.

BRIEF FOR APPELLEE

United States Court of Appeals

DISTRICT OF COLUMBIA CIRCUIT

APPEAL NO. 10,905

FLORENCE M. FORD, ANNE E. HALL, EXECUTRIX OF THE ESTATE OF WILLIAM P. HALL, DECEASED, AND JOSEPH BANCROFT & SONS CO., APPELLANTS

v.

JOHN A. MARZALL, COMMISSIONER OF PATENTS, APPELLEE

APPEAL FROM THE JUDGMENT OF THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

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United States Court of Appeals
District of Columbia Circuit
FILED MAY 3 1951
CLERK

QUESTION PRESENTED

In the opinion of appellee the question is: Is appellant entitled to a process patent where it is conceded that the physical steps defined in the process are individually and collectively old in the art, where the material administered is analogous to that used by appellants, and where the product produced differs at most from the product of the prior patents considered individually or collectively in degree only?

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BRIEF FOR THE COMMISSIONER OF PATENTS

INTRODUCTION

This is an appeal from the judgment (61)* of the United States District Court for the District of Columbia, dated November 22, 1950 dismissing appellants' complaint (2-6) against the Commissioner of Patents, in an action under Section 4915 of the Revised Statutes—35 U.S.C. sec. 63 —, Civil Action No. 5217-48, in which appellants sought to have the District Court issue an order authorizing the Commissioner to grant a patent containing certain claims (4, 5) of the Ford and Hall patent application, Serial No. 567,118, filed December 7, 1944 on an alleged invention in a "Method of Producing Permanent Mechanical Finishes on Fibrous Materials". The complaint was dismissed because the claims sought are unpatentable in view of the prior art (60).

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* Numbers in parentheses refer to pages of the joint appendix.

APPELLANTS' APPLICATION

The specification of the application at bar (63-71) describes the alleged invention as one relating to the production of permanent mechanical finishes on fabrics, such as cotton fabrics, which are permanent in the sense that they will resist repeated washings, such as with soap solutions or with dry cleaning solvents, with no objectionable loss of finish (64). The fabric is prepared by applying thereto a resinous product obtained by reacting a carbohydrate with an aldehyde in the presence of a catalyst, and thereafter imparting the desired finish and curing the resinous product in and on the fabric, the curing being accomplished in whole or in part simultaneously with the finishing operation, or subsequent thereto. More specifically, the process involves the application of the carbohydrate-aldehyde reaction product in aqueous solution or mixture, the drying to about 10% moisture content, the application of a mechanical finish, the curing, the washing, and finally drying (64). Starch is the preferred carbohydrate, formaldehyde, the preferred aldehyde, and ammonium thiocyanate the preferred catalyst, although other specific materials falling within the classes disclosed are described (65).

THE CLAIMS

The claims appear in paragraph 9 of the complaint (4, 5) numbered 22 to 31 inclusive. They are all directed to the method or process which finds its broadest expression in claim 22. Appellants apparently agree that this claim is the broadest (Br. 4). As appears from a mere inspection of the claims all others are dependent from and therefore are more specific than claim 22. While appellants state that "if claim 22 is patentable over the art, then all the rest, being more limited than 22, are patentable too" (Br. 13), no contention has been specifically made, that all the other claims would be patentable even if claim 22 were to be held unpatentable. Accordingly, it would appear to be proper to state that all the claims stand or fall together.

THE PRIOR ART

The patent to der Horst, 2,009,765 (87), granted November 23, 1937 relates to a process of finishing textiles by treating them in aqueous medium with an aldehyde and starch or with reaction products of aldehyde and starch which yield pastes in water (87, 88), a catalyst, such as an acid reacting compound being added to the starch before or after the treatment with the aldehyde (89). The textiles are soaked in a bath containing the starch preparation in a pasted state, and then dried at an elevated temperature, about 100° C (89). The patent states that by operating in this manner finishings are obtained which are very stable to washing, even after repeated washing with soap and soda (89). The amount of finishing material retained in the fabric varies between 5 and 20 per cent, based on the fiber weight, and is preferably between 10 and 15 per cent (89, 90).

The patent to Lippert, 2,148,316 (96), granted February 21, 1939 describes a process of producing chintz, and states that its primary object is an improved process for finishing chintz, providing a surface which will retain its lustre even after repeated launderings (96). To accomplish this result the patentee prepares in the cold an aqueous solution of urea formaldehyde, to which is added as a catalyst, an acid salt, and as a softening agent, ethyl cellulose (98). The cloth is impregnated with this solution, dried at a temperature between 150°F and 200°F to a point that it retains about 10% moisture, and then subjected to a treatment adapted simultaneously to glaze and apply heat upwards of about 320°F (98, 99). Oven treatment may follow to insure setting of the resin (99). The mechanical finish thus imparted is relatively permanent (99).

The publication by Ellis, The Chemistry of Synthetic Resins, describes the formation of resinous products from ammonium thiocyanate and formaldehyde directly, particularly when the latter is used in excess (102, 103). Further, this publication describes the impregnation of textiles with soluble condensation products of formaldehyde and ammonium thiocyanate in the presence of urea, the treated fabric being dried and then heated to complete the polymerization of the impregnant (104).

SUMMARY OF ARGUMENT

1. Each of the patents to der Horst et al and Lippert discloses a process for finishing textile fibers or fabrics

to make them mechanically stable and fast to washing involving the application of a sizing solution containing a carbohydrate and an aldehyde.

2. The patent to Lippert admittedly discloses all the steps or operations defined in the claims sought, and in addition the use of a sizing solution which is covered by the broad and inclusive language of base claim 22. Though other materials are also contained in Lippert's sizing solution the claim does not expressly exclude such materials. Consequently, the defined process is unpatentable.

3. The patent to der Horst et al. utilizes a sizing solution essentially identical with that disclosed in the application at bar, and processes the sized material in substantially the same way subsequent to the sizing operation. Though the patentees do not speak of utilizing a pressure mechanical finish they do mechanically finish, and since pressure mechanical finishes are concededly old the use of such a finish in der Horst would not be invention.

4. The evidence as to the superiority of appellants' product is inconclusive, first because it was not made according to the process broadly claimed as inventive here, and second, because, the superiority is merely a matter of degree. All improvement is not invention.

5. Even if it should be held that each patent individually does not anticipate, the combination of the two is obvious to one skilled in the art, and the utilization of features of each, obtaining no unusual or surprising results, is not invention and is not entitled to patent protection.

THE ARGUMENT

Since all the claims sought have been refused on the same references or combination of references, all the claims may be considered as a unit. If this combination of references is proper, all the claims are unpatentable; if the combination is not proper, then, as appellants point out (Br. 13) all the claims are patentable. Therefore, the issue as to all claims may be determined best by a consideration of claim 22, upon which all the other claims depend, since this claim admittedly presents in its broadest aspect the subject matter for which patent protection is sought (Br. 4).

Turning to claim 22 (4) it asserts that appellants' alleged invention relates to a process of imparting durable lustrous mechanical effects to cellulose and regenerated cellulose fibers and fabrics, which process comprises the following steps:

(1) sizing . . . with a water solution containing a polysaccharide carbohydrate and an aldehyde selected from a specified group of compounds;

(2) drying . . . to dampness;

(3) imparting a lustrous mechanical finish . . . by a pressure mechanical finishing machine;

(4) curing . . . by heating . . . to from substantially 280° F. to substantially 400° F.

Insofar as these procedural operations are concerned appellants conceded at the trial and they admit here that these steps, as steps or physical operations, were known to the art, and that they are collectively old in the art (Br. 19). Presumably they concede that all these steps are disclosed in the patent to Lippert, for as stated in the brief no testimony was offered with reference to Lippert (Br. 19). However, it is submitted that Lippert discloses much more than the bare physical steps. Lippert discloses also a sizing solution which is closely similar or analogous to the sizing solution defined in claim 22. That ethyl cellulose in Lippert's solution (98) is a polysaccharide carbohydrate, is abundantly clear from the fact that that identical material is disclosed in the specification of the application at bar (65), and from the fact that appellants' witness admitted as much on cross-examination (40). Further, the water soluble urea formaldehyde in Lippert's sizing composition is stated by appellants to be an aldehyde containing compound (Br. 20) and is characterized by Dr. Hall as resin forming materials in an initial state of polymerization, just as appellants' paraformaldehyde and hexamethylene tetramine are described as polymerization products of formaldehyde (65). In addition, it should be noted that of the fourteen specific examples of sizing solutions used by appellants (68, 69), twelve contain ammonium thiocyanate. Although appellants ascribe a catalytic function to this material (65) there is evidence to indicate that ammonium thiocyanate may react with formaldehyde to produce resinous products, the rate of reaction and the degree of reaction being dependent to a great extent upon proportions and temperature (102, 103). Therefore appellants' claim defining a sizing solution containing a polysaccharide carbohydrate and an aldehyde selected from a group of aldehydes including polymers does not expressly exclude the presence of other materials, even resinous, although it would appear from appellants' brief that the claim is being interpreted as if it were limited to the use of starch and aldehyde only (Br. 11). Since the claims in a pending application must be interpreted broadly, In re Hooker, 36 CCPA 1164, 175 F. 2d 558; In re Seabury, 23 App. D. C. 377, it is submitted that the Lippert patent teaches not only the physical operations or steps defined in claim 22, but also the use of a sizing composition encompassed within the scope of the sizing composition defined in the claim. These facts, coupled with the fact that the result achieved by the process claimed herein is no different from that of Lippert, for Lippert imparts a permanent or durable lustrous mechanical finish to fabrics also, constitute clear support in the evidence for the trial Court's holding that the method of application and finishing is anticipated by the Lippert patent (60). Moreover, even if it be considered that the sizing composition of Lippert is not covered or included within the broad language defining the sizing solution of claim 22, it is submitted that they are sufficiently analogous to fall within the rule that where an old process is used in the administration of an analogous material, and the result accomplished is due solely to the quality of the material used, no inventive method is involved. Paramount Publix Corp. v. American Tri-Ergon Corp., 294 U. S. 464; Graver Tank et al. v. Linde Air Products Co., 336 U. S. 271; Dow Chem. Co. v. Coe, 76 U. S. App. D. C. 317; In re Saunders, 33 CCPA 1001, 154 F. 2d 693. Considered in either light, the decision of the trial Court is not clearly erroneous and therefore should be sustained. Abbott v. Coe, 71 App. D. C. 195, 197.

Now, considering the patent to der Horst (87) and the findings of the trial Court that the chemical compounds used in appellants' process are clearly the same as those used in the Horst et al. patent, and that the method of application and finishing is anticipated by the Horst et al. patent (60), it is necessary to consider in more detail the individual disclosures. Looking to the patent we find that the patentees stated that textiles may be finished by treating them "in an aqueous medium with a compound capable of reacting as an aldehyde and starch in a form capable of yielding a paste, preferably in the presence of acid-reacting substances." (87). The compounds capable of reacting as an aldehyde are "formaldehyde", "hexamethylene tetramine" (87), and "paraformaldehyde" or "condensation products of formaldehyde and acetone" (88). The process is carried out by drying starch in the presence of the aldehyde on the fibre in the presence of acid reacting substances (87), or by an alternative process consisting in treating the fibres with reaction products of formaldehyde and starch which are still capable of yielding a paste and subsequently drying at elevated temperatures (87, 88). The alternative process is more specifically described in the patent, and of the specific examples all except 10, 11 and 12 (93) describe treatments involving the use of pre-reacted starch and aldehyde, with example 9 (93) showing the addition of additional aldehyde before the sizing solution is applied to the fabric. In examples 10, 11 and 12 (93) the starch compound capable of reacting as an aldehyde and the acid reacting compound are "pasted" with or without heat in aqueous solution, then applied to the fabric and dried.

Comparing this prior disclosure with that of the application at bar it is found that the applicants state that "we apply to the fabric the resinous product obtained by reacting a carbohydrate and an aldehyde (preferably in the presence of a catalyst)" (64); that the resinous material is applied in the form of an aqueous solution or mixture, the carbohydrate used being such as dissolve in either cold or hot water or as will produce a smooth colloidal dispersion in water (64). Further, the applicants state that with some carbohydrates this condition is brought about by heating the carbohydrates dispersed in water either directly with the aldehyde (65), and that by operating in this manner, the carbohydrate and aldehyde are semi-reacted (69). This description of the application closely parallels the description in der Horst of treating the fibres with reaction products of formaldehyde and starch (87) which are still capable of yielding a paste (a colloidal dispersion) with water (88). As for the aldehyde the application discloses formaldehyde, paraformaldehyde and hexamethylene tetramine (65), which are identical with those taught in the der Horst patent; and with respect to the catalyst used, applicants describe a preference for ammonium thiocyanate (65), which is exactly the same compound that der Horst uses in examples 1, 2, 5, 6, and 11 (90-93) denominated as ammonium sulfocyanide. Accordingly, it is submitted that insofar as the sizing composition is concerned and its method of application to the fabric base the disclosure of the application and the teaching of the patent are substantially identical. Hence, step (1) of the process defined by claim 22 is fully met.

Appellants' brief in discussing the der Horst patent states that the patentee was concerned with only one problem, namely, reducing the solubility of ordinary starch (Br. 16), and that the presence of "free aldehyde" in the starch composition would be detrimental to the basic concept of der Horst (Br. 17). On the contrary, it is believed that the patent disclosure makes it crystal clear that the prime purpose of the patentees was to obtain textile finishings which are very stable to washing (89), for in each specific example the stability to washing is pointed out and emphasized. Also, while appellants repeatedly state that the presence of "free aldehyde" in the sizing solution is necessary to accomplish their results (Br. 13, 15, 17, 20, and 22), it should be noted first, that the sizing solution described in example 9 (93) will contain "free" aldehyde when it is applied to the fabric, and second that there is no express limitation in claim 22 which requires "free" aldehyde to be present in the solution. The whole contention as to "free" aldehyde is by implication, the witness having stated that the word "aldehyde" in the claims implied that it is "free aldehyde" (34). However, when it was pointed out to the witness that the appellants had disclosed in their application that paraformaldehyde and hexamethylene tetramine could be used in the sizing solution, and he was asked whether "free aldehyde" would be present in a solution containing those compounds, the answer was that there was no "free aldehyde" in such solution (36, 37). Furthermore, since claim 25 (4) specifically recites, in addition to the limitations of claim 22, the use of "an excess of aldehyde over the amount required to react with the carbohydrate'', which excess was interpreted by the witness as ''free'', that implication would appear to be destroyed completely. Claim 22 being without that express limitation it must be presumed that appellants meant claim 22 to be broader than claim 25. Giving that claim the broadest interpretation, as is required under the authorities—In re Seabury, 23 App. D. C. 377—it is submitted that plaintiffs' contentions respecting the presence of ''free aldehyde'' are without merit.

Step (2) of the claim calls for drying the sized material to dampness. Appellants' brief does not comment on this particular step of the process; it is assumed that its disclosure in the prior art is admitted. But apart from any admission, it is pointed out that der Horst in example 5 (91) speaks of slinging off the sizing material, and in example 8 (92), of squeezing the sized fabric; obviously, methods of removing excess water and sizing solution so as to obtain a damp or wet material.

Step (3) of the claim calls for imparting a lustrous mechanical finish by a pressure mechanical finishing machine. While appellants admit that der Horst patent mentions the use of mechanical finishing machines (Br. 18) it is contended that those machines do not impart a mechanical effect to the fabric (Br. 18). In connection with this contention it should be noted that appellants' application states that it is well known in the art to impart pressure mechanical finishes to fabrics (64), so that this step adds nothing new. It differs, if it differs at all from those disclosed in der Horst, solely in the word pressure.

Step (4) of the claim calls for a final heating step of from substantially 280° F. to substantially 400° F. Appellants admit that der Horst discloses a final heating step of 250° F. (Br. 18). Since appellants indicate that temperatures lower than those specifically designated may be used (67), it would appear that the temperature is not critical since the lower temperature would require a longer time, and the higher temperature a shorter time in the heating oven (67).

Der Horst discloses essentially the same four steps in producing a textile finish which is said to be mechanically stable and fast to washing (92). The slight variation in the temperature used in the final heating step, and the slight variation in the mechanical finishing operation are obvious to those skilled in the art, and hence non-inventive. If a teaching of these variations is necessary in order to negative invention, that teaching appears in the Lippert patent, but even without such prior knowledge, it is submitted that it would be obvious to pressure mechanical finish in der Horst, if one desired such a finish.

Appellants contend that the combination of der Horst and Lippert suggested by the tribunals below was actually made and tested, and that that combination will not produce the product described and claimed in the application at bar (Br. 22). In other words, appellants assert that the combination of the two is inoperative to realize appellants' objective (Br. 25).

In connection with this contention and the evidence upon which it is based, it is important to note that the tests and comparisons were of a product made according to examples 4, 6, 9, and 11 of der Horst using the pressure mechanical finishing and curing operation of Lippert, on the one hand, and of a product made according to E, L, M and M-1 of the appellants' application, on the other hand (50). As appears from the cross-examination (55) all the samples made of appellants' process contained ammonium thiocyanate. No sample of a product according to claim 22 was run, so that there is no evidence in the record comparing the product of der Horst modified by Lippert with the product of claim 22. Manifestly, the proper way to show superiority or the difference between the results obtained is a direct comparison of the product of claim 22, which does not specify a catalyst, such as amomnium thiocyanate, with the product of the prior art. This type of test would appear to be a minimum requirement if appellants are to assert that the combination as proposed does not produce the desired result or is inoperative to achieve appellants' objective. Blanchard v. Ooms, 80 U. S. App. D. C. 400.

Apart from this objection to the evidence relied upon it is to be noted that the superiority alleged in the product made according to appellants' examples is merely one of degree. The witness stated that appellants' product possessed a higher luster and a higher crease resistance (50), though as to the latter, no tests were made (55, 56), this being purely opinion. Further, the same witness testified that sample 9 made according to the combined prior art disclosures would be acceptable commercially as a fabric having a durable mechanical finish applied to it (50). That being true, the conclusion appears inescapable that the combination of the two prior art disclosures does produce and is operative to realize appellants' objective, though possibly not to the degree achieved by appellants. Although appellants' process or the product thereof may be an improvement over the combination of the prior art processes, the rule is well established that all improvement is not invention and entitled to protection as such. Pearch v. Mulford, 102 U. S. 112; Minn. Min. & Mfg. Co. v. Coe, 69 App. D. C. 256. As pointed out in A & P Tea Co. v. Supermarket Equip. Corp., 340 U. S. 147, to sustain a combination made up entirely of old components there must be some unusual or surprising consequences resulting from the union of old elements. It is submitted that a mere difference in degree of luster and crease resistance is not such as to show invention in the combination of the prior art disclosures.

Although it is believed that all the claims stand or fall with claim 22, and that no separate consideration need be given the individual claims, nevertheless, a brief statement with respect to each claim will be made to show that the more specific statements therein present nothing new or inventive.

Claims 23 and 24 (4) can be considered together, for these claims relate the mechanically finishing operation and curing operation to each other more specifically, than might be inferred from claim 22. In claim 23 the operations are defined as being sequential, while in claim 24, they are accomplished substantially simultaneously. Ordinarily in process claims steps taken concurrently are the equivalent of steps taken successively. Asbestos Shingle v. Rock Fibre, 217 F. 56; In re White, 17 CCPA 956, 39 F. 2d 974. Since both der Horst and Lippert show successive treatment it is submitted that these claims define nothing new or inventive.

Claim 25 (4) adds the thought of using an excess of aldehyde over the amount required to react with the carbohydrate. Apart from the fact that der Horst clearly discloses the concept of adding additional aldehyde to the sizing solution containing a pre-reacted product of carbohydrate and aldehyde (Ex. 9-93), it should be noted that the difference between the product made with or without such excess is characterized by appellants' witness as being very slight (56). Under these circumstances, this limitation is without patentable significance.

Claim 26 (4) defines a sizing solution containing a preliminarily reacted carbohydrate-aldehyde material. The der Horst patent utilizes a pre-reacted product, the reaction temperature being either room temperature or 90° C (204° F.), a temperature which falls within the range specified in this claim.

Claim 27 (5) specifies a curing temperature of approximately 350°F. Although this temperature is higher than the 250° F. of der Horst's example 9 (93), it is well within the range of 320° F. to 400° F. described in Lippert (99). Accordingly, there is nothing new in this limitation over the combination of der Horst with Lippert.

Claim 28 (5) specifies the use of a catalyst and a proportion of chemicals adjusted to give to the cured material a pH of from substantially 4 to 5. Both prior art patents use acid reacting substances in the sizing solution, Lippert denominating his a catalyst (98). Since der Horst utilized the same substance, ammonium thiocyanate, it follows that the same function is performed, and though the patent does not mention pH it does caution against the use of too acidic materials (88). Moreover, no particular importance is attached to this pH limitation other than at lower pH (two acid) undesirable tendering takes place, which is essentially what der Horst warned against. Under these circumstances it is submitted that these limitations are of no patentable significance.

Claim 29 (5) merely specifies that the aldehyde is formaldehyde. Since both der Horst and Lippert disclose formaldehyde, obviously this claim falls with claim 22.

Claim 30 (5) is specific to formaldehyde as the aldehyde and ammonium thiocyanate as the catalyst. Since der Horst discloses both these specific materials, this claim too stands or falls with claim 22.

Claim 31 (5) essentially specifies as an added limitation that the mechanical finish is imparted by friction glazing. Since appellants admit that the various specific mechanical finishes are old in the art (64), the specification of a particular old finish adds nothing new or inventive to the basic process defined in claim 22. Though more specific it is so because of the inclusion of old features. This claim is unpatentable over the references applied to base claim 22.

CONCLUSION

It is submitted that for the reasons detailed herein none of the claims involved defines patentable subject matter over the prior art, that the conclusions reached by the Patent Office tribunals and the trial Court were correct, as having a rational basis in the record, and that the decision appealed from should be affirmed.

Respectfully submitted,

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May 1951.

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BRIEF FOR APPELLANTS.

IN THE

United States Court of Appeals

DISTRICT OF COLUMBIA.

United States Court of Appeals
District of Columbia Circuit
FILED APR 10 1951
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CLERK

No. 10,905.

FLORENCE M. FORD,
ANNE E. HALL, Executrix of the Estate of
William P. Hall, Deceased, and
JOSEPH BANCROFT & SONS CO.,
Appellants,

v.

JOHN A. MARZALL, Commissioner of Patents,
Appellee.

On Appeal from a Judgment of the United States District Court for the District of Columbia Dismissing the Complaint in a Suit to Obtain a Patent.

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The question presented is: Is a process patent properly refused upon the basis of two prior art references, when the unrebutted proofs show (a) that neither of the two prior art references taken alone anticipates the claims sought; (b) that when the two references are combined (the treating agent of one being employed according to the physical process steps disclosed by the other), they are inoperative to produce the durable-to-water lustrous mechanical finish to the obtaining of which the claims sought are directed; and (c) that the result of the claimed process was surprising and unexpected to one skilled in the art?

IN THE

United States Court of Appeals

DISTRICT OF COLUMBIA.

No. 10,905

FLORENCE M. FORD,
ANNE E. HALL, EXECUTRIX OF THE ESTATE OF
WILLIAM P. HALL, DECEASED, AND
JOSEPH BANCROFT & SONS CO.,
Appellants,
v.
JOHN A. MARZALL, COMMISSIONER OF PATENTS,
Appellee.

BRIEF FOR APPELLANTS.

May it please the Court:

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JURISDICTIONAL STATEMENT.

This is an appeal from a final decree of the United States District Court for the District of Columbia, dismissing Plaintiffs' Complaint in an action to secure a patent. This Court has jurisdiction by virtue of 28 US Code 1291; Act of June 25, 1948, C. 646, Sec. 1; 62 Stat. 929. The Lower Court had jurisdiction by virtue of 35 US Code 63; Revised Statutes, Sec. 4915; Act of February 9, 1893, C. 74, Sec. 9; 27 Stat. 436, as amended by Act of Aug. 5, 1939; 53 Stat. 1212.

The Complaint is printed in full, at App. 2-6; Jurisdictional averment is found in Count I; identification of the original parties in II, III, IV, and V; title is pleaded in VII; and the cause of action is set out in the remaining counts. The answer is printed at App. 7-8. It admits all allegations of the Complaint except for Counts XII and XIII, to which it interposes a qualified denial, and offers a formal correction for Count V (change "legal residence" to—official residence—).

Florence M. Ford and William P. Hall jointly invented the invention for which a patent is sought herein, and assigned all of their rights to Joseph Bancroft & Sons Company, the real party in interest. While the action was pending, Hall died, and his executrix was substituted as a party plaintiff (App. 9-10).

Defendant, Lawrence C. Kingsland, was succeeded as Commissioner of Patents by John A. Marzall, during the pendency of the action, and said Marzall was timely substituted, in his official capacity, as party defendant (App. 9).

STATEMENT OF THE CASE.

A. PROCEEDINGS BELOW:

Ford and Hall, as joint inventors of a new and useful "Method of Producing Permanent Mechanical Finishes on Fibrous Materials", filed an application for patent on that invention in the United States Patent Office. The application was filed on December 7, 1944, and was given Serial Number 567,118. The entire specification of this application is printed at App. 63-71; the original claims were subsequently replaced by Claims 22-31, which are printed in full at App. 4-5. A certified copy of the file and contents of the Ford and Hall application has been sent up as a physical exhibit, Plaintiffs' Exhibit 2. The inventors assigned all rights to Joseph Bancroft & Sons Company. The application was in usual form and was duly prosecuted. Only two references were cited during prosecution. These were the following patents:

Horst et al.	2,099,765	Nov. 23, 1937	(App. 87-96)
Lippert	2,148,316	Feb. 21, 1939	(App. 96-101)

The Primary Examiner, on August 26, 1946, finally rejected all claims remaining in the case, these being Claims 22 to 31, inclusive, printed at App. 4-5.

An appeal to the Board of Appeals was timely filed—on February 24, 1947. The Examiner's Statement on appeal is printed at App. 75-77. It asserts, *inter alia* (App. 77), that: ". . . the steps of the process as set forth in applicants' claims are clearly anticipated by the combined teachings of Horst and Lippert." The Board of Appeals sustained the Examiner's rejection, in an opinion dated July 8, 1948. This opinion seemed to suggest (paragraph bridging App. 77-78) that Horst alone anticipated the claims. A Request for Reconsideration was therefore filed, this being found at App. 81-85. In a supplemental opinion the Board said that the paragraphs following the one just cited "constituted a clear indication that derHorst was *not** considered as disclosing a '*pressure** mechanical finishing machine' and that Lippert was relied upon as disclosing this feature" (App. 86). No appeal to the Court of Customs and Patent Appeals was taken from the Board's refusal, but within six months of the Board's original opinion, namely, on December 31, 1948, the Plaintiffs instituted the present action, in the District Court.

Subsequent to the filing of the Complaint in this action, tests were conducted at the Bancroft plant, in the presence of Mr. Schimmel, of counsel for the defendant herein, to show what would happen if derHorst's material were to be applied to a fabric, and the fabric were to be thereafter processed according to the Lippert patent; and what takes place when the teachings of the application in suit are followed.

Testimony with reference to these tests was adduced upon the trial of the case, this being found in the Appendix, at pages 46-57.

Other testimony was taken, during the trial, this being printed in its entirety at App. 10-57.

The trial was held on October 30, 1950. At its conclusion, counsel were requested to present oral argument immediately. Leave to file briefs was refused. (Tr.—Orig. Minutes of Trial, p. 87.)

The opinion of the Court was embodied in a letter dated October 31, 1950, addressed to Counsel for the parties. This is printed at App. 58. Pursuant thereto, proposed findings of fact and conclusions of law were prepared and submitted to the Court by Counsel for the Defendant. These were adopted without change by the Court, and filed, together with the Judgment, on November 22, 1950 (App. 59-61). The present appeal was filed December 21, 1950 (App. 61). Contents of the Record on appeal were settled in a Stipulated Designation (App. 62-63), and the portions to be printed in the Appendix were agreed upon by a "printing stipulation", which latter document has not been reproduced.

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* Emphasis quoted.

B. THE INVENTION IN ISSUE:

The invention for which patent protection is sought is briefly and concisely stated in its broadest form in Claim 22, which may be analyzed as follows:

> "22. The process of imparting durable lustrous mechanical effects to cellulose and regenerated cellulose fibers and fabric . . ."

["Durable" means washable—not marrable or spottable by water, nor destroyed by laundering or dry cleaning. "Mechanical effects" are *lustrous* finishes obtained by physically deforming (flattening) the yarns and fibers of which yarns are composed, which can only be produced by machines capable of subjecting fabrics to tremendous pressure of the order of 1000 pounds per inch. "Cellulose" means, for practical purposes, cotton; "regenerated cellulose" means viscose, and similar rayons. "Fibers" are infinitesimally small filaments, many thousands of which are spun together to form a single "yarn" or "thread". "Fabric" is the gross material woven from yarns or threads.]

> ". . . which comprises sizing the material with a water solution containing a polysaccharide carbohydrate . . ."

["Sizing" means coating. The commonest form of polysaccharide carbohydrate is starch. All natural starches are comprehended within this term. It also is broad enough to cover certain specialized products, such as methyl cellulose. Starches (and other polysaccharide carbohydrates) are characterized in that the individual molecules of which the material is made are of very great size. They are too big to "impregnate" (i. e., "penetrate into") the cells of which a cellulosic fiber is composed. They lie on the surface of the fibers.]

> ". . . and an aldehyde selected from the group consisting of formaldehyde, paraformaldehyde, glyoxal, and acetaldol . . ."

[These are the lower, more active aldehydes. Ford and Hall teach that the aldehyde and the starch may be applied to the fabric in the form of a single solution, or they may be sequentially applied, but the final size must include a carbohydrate and an aldehyde, i. e., *free* aldehyde, as will further appear.]

> ". . . drying the material to dampness . . ."

[The material must not be completely dried, because starch is not plastic in the dry state, and it must be plastic when the following step is applied, so that it can "flow" under the pressure of the calender rolls.]

> ". . . imparting a lustrous mechanical finish to the material by a pressure mechanical finishing machine . . ."

[Any "pressure mechanical finishing machine" will impart luster to a fabric. Several types of such machines are in common use, for producing "mechanical effects" known as chintz finishes, embossed finishes, moire finishes, and so on. All such finishes are characterized in that they can be produced only by the application of extremely great pressure of the order of 1000 pounds to the inch.]

> ". . . and curing the treated material by heating the material to from substantially 280°F. to substantially 400°F."

["Curing" is a broad general term. But curing within the temperature ranges given is a very important part of the present process, for it is only at such temperatures that the aldehyde will react with the cellulose to chemically bond it to the starch and thus make the finish permanently a part of the fabric. This reaction is what makes the mechanical finish "durable", for the reaction product, a cellulose-aldehyde-starch, is not soluble in water, and cannot be removed by laundering.]

STATEMENT OF POINTS.

1. The District Court erred in dismissing the complaint herein, and in failing to hold that Plaintiffs were entitled to a patent containing Claims 22 to 31, inclusive, of Plaintiffs' application.

2. The District Court erred in holding the claims in issue unpatentable in view of the prior art, it being established by unrebutted evidence adduced at trial that neither of the two prior patents relied on by the Patent Office both utilizes the materials and applies the physical steps necessary to perform the process and produce the result claimed; and it being further established that even when the respective processes are combined in the way which the Patent Office regarded as obvious, the combination will not produce the result described and claimed in Plaintiffs' application.

3. The District Court stated in Fact Finding No. 3 that the Horst et al patent teaches "passing the treated fabric through a finishing machine." If the Court intended to suggest in this finding that the derHorst patent teaches the application of a finish by the use of a "pressure mechanical finishing machine", as defined in the claims of the present application, then the Court is plainly in error in this respect. (The Board of Appeals at App. 86 said ". . . derHorst was *not* considered as disclosing a *pressure* mechanical finishing machine".)

4. The District Court in Fact Finding No. 3 asserts that in the derHorst patent "The finished fabrics (of derHorst) are described as being mechanically stable and fast to repeated washings with soap and soda." If by this finding the Court intended to suggest that a durable lustrous mechanical finish can be obtained with the preparation and methods of derHorst, this is in error.

5. The District Court, in Fact Finding No. 4, held that, according to the Lippert patent, "Cloth is impregnated

with an aqueous solution containing urea formaldehyde, ethyl cellulose and an acid catalyst . . .". If the District Court meant to imply that the solution used contained urea and formaldehyde as such, the Court was in error in this respect. Urea-formaldehyde *resin* is a definite chemical *compound,* and it is urea-formaldehyde *resin* which Lippert uses.

6. The District Court in Fact Finding No. 5 held "The chemical compounds used in Plaintiffs' process are clearly the same as those used in the Horst et al patent." This is in error. Plaintiffs' process necessitates the presence of free aldehyde in the fabric at the time of curing. No free aldehyde would be present "at the time of curing" if the derHorst fabrics were to be cured. In this crucial respect, the chemical compounds used in Plaintiffs' process are *not* the same as those used in the Horst et al patent.

7. The District Court in Fact Finding No. 6 stated: "The method of application and finishing is anticipated by both the Horst et al patent and the Lippert patent." This is in error. Applicants' method of finishing is not shown in the Horst et al patent. Applicants superficially coat fibers with a starch sizing preparation; Lippert "impregnates" the fibers, and with a different preparation.

8. The District Court in Fact Finding No. 7 erroneously states that "While Plaintiffs' variation of the basic process may obtain more predictable results and may be an improvement over the prior art, it is such as flows from the natural development of the art by one skilled in the field, and is not invention." Plaintiffs' invention is more than a "variation" of the basic process, and the results which it attains are not merely "more" predictable. It obtains *wholly* predictable results, where the prior art did not. Direct testimony by a disinterested witness highly skilled in the field asserts that the attainment of Plaintiffs' results is surprising and unexpected, and explains why this is so.

9. The District Court found (Finding No. 8) that: "The process which Plaintiffs seek to patent has been anticipated by the prior art." (It has been shown *supra* that the findings upon which this conclusion is based are erroneous.)

10. The District Court held, in Fact Finding No. 9, "Claims 22 to 31, inclusive, here involved are unpatentable in view of the prior art." This is a conclusion of law and not a finding of fact.* It cannot be sustained, inasmuch as the facts upon which it is predicated have been erroneously found.

SUMMARY OF ARGUMENT.

Fundamentally considered, the issue in this case is very simple indeed. Plaintiffs aim to impart permanence or durability to the lustrous mechanical effect imposed upon a fabric by pressure mechanical finishing machines, using for this purpose starch and free formaldehyde, or their equivalents. The fabric is sized with these materials before finishing, and is heat cured during, and if necessary, after finishing. When curing temperatures are applied, the free aldehyde present reacts with the cellulose of the textile fibers, to form an insoluble reaction product of cellulose, aldehyde and starch. Once this reaction has occurred, the fabric may be washed or cleaned as often as desired without harm to the lustrous finish.

Patent was refused on the ground that there was nothing inventive in the proposal, because a prior patentee, Von derHorst, et al., had disclosed the preparation of a modified starch—one which had been reacted with an aldehyde to decrease its solubility,—and the use of that starch as a size for fabrics which were *not* thereafter subjected to mechanical finishing machines; and another prior patentee, Lippert, had taught that it was possible to make a lustrous mechanical finish durable by applying a urea-formaldehyde resin to the fabric, drying it to dampness, calendering it on a pressure mechanical finishing machine, and heating it to convert the resin into an insoluble state *in* and on the fibers of the fabric.

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* The Great Atlantic & Pacific Tea Company vs. Supermarket Equipment Corp., 71 S. Ct. 127 at p. 131.

The heart of the Patent Office's rejection is that no invention would be involved in applying to a fabric the material suggested by derHorst, and then subjecting the fabric to partial drying and mechanical finishing with heat as taught by the Lippert patent.

Entirely apart from the fact that there is nothing in either patent to suggest that such a combination of processes might or could be made, the controlling fact is that when the two prior art processes are combined as suggested by the Patent Office, the lustrous mechanical effect produced is not washable, and does not meet the requirement of the claim that a "durable" effect is produced.

This controlling fact was established by tests conducted after the commencement of the present action in the presence of a representative of the Commissioner of Patents. Testimony with respect to these tests is found in the Appendix at pages 46-57. Plaintiffs' physical Exhibit 4 shows that washing removes the lustrous finish from fabrics processed according to the combined techniques of derHorst and Lippert. Plaintiffs' physical Exhibit 5 shows that the lustrous mechanical effect produced by the process in suit is in fact durable to washing.

It is obviously improper to reject claims to a process for producing a given result, on a combination of prior art references which is incapable of producing the result described and claimed.

The District Court apparently was prepared to go even farther than the Patent Office, for it held that: "The method of application and finishing is anticipated by both the derHorst, et al., patent and the Lippert patent." If this finding means that either patent alone is adequate to anticipate the process in suit, it is clearly erroneous, for reasons which will be more fully developed hereafter. The Lower Court also held that: "The process which plaintiffs seek to patent has been anticipated by the prior art." Since the prior art does not employ the claimed means nor produce the claimed result, it does *not* anticipate. That which fails does not anticipate that which succeeds.

The key to success in applicants' process is the presence of free aldehyde in the fabric, to react with the cellulose at the time of curing. The claim requires that the fabric be sized not only with starch or its equivalent, but also with an aldehyde, and the specification explains why this must be done. This is a feature which is not taught or suggested in either the derHorst patent or the Lippert patent. *Why* plaintiffs' process succeeds where the prior art fails is really of secondary importance, compared to the stubborn fact that the prior art does fail. Nevertheless, reasons for that failure will be explained in the argument which follows.

ARGUMENT.

The Ford and Hall Process in Issue.

The essential features of the process in suit have been outlined above. They may be recapitulated here.

Essentially, the process requires the sizing of a textile fabric with a water solution containing a polysaccharide carbohydrate, e.g., starch, and with an aldehyde, e.g., formaldehyde, as such. These materials may be mixed together and *semi*-reacted by heating the solution or dispersion for an appreciable time. "*Semi*-reacted" obviously means that more reaction is possible—that there is free aldehyde and starch in the material after heating. Alternatively, the carbohydrate may be dispersed in water with heating and the aldehyde added to the cooled solution. Alternatively, carbohydrate may be dispersed in water and this dispersion applied to the fabric, the fabric being thereafter treated with the aldehyde. Conversely, the aldehyde may be applied first, and the fabric afterwards treated with the carbohydrate disperson. These alternative procedures are clearly set out in the Ford, et al., specification (see last three lines of Page 69 and the first three paragraphs of Page 70 in the Appendix). No matter which technique is followed, the result will be a fabric which has been sized with "an aqueous solution containing a polysaccharide carbohydrate and an aldehyde," as required by every claim in suit.

After the fabric has been sized with the starch and with the aldehyde, it is dried to dampness—that is, to a moisture content of approximately 10%. (See App. 64—9th line from the bottom.) This is important, as explained in the Hall affidavit (App. 74—paragraph 9), because in the softened moist state the sizing material will "flow" under the influence of the pressure of the finishing machine. If the starch sizing on the fabric were completely dry, it would be difficult or impossible to apply a satisfactory mechanical finish.

The partially dried fabric is then passed between the rolls of a pressure mechanical finishing machine. As previously noted, these machines are capable of exerting tremendous pressures, ranging from 10,000 pounds to 50,000 pounds per square inch applied at the bearings (Hall affidavit App. 73) or about 1,000 pounds per square inch applied to the fabric (Squier App. 54). Under such tremendous pressure, not only the gross structure of the yarns which make up the fabric is modified; even the infinitesimal fiber from which the yarns are spun is deformed and distorted (App. 13).

Pressure mechanical finishing machines, used to perform this operation ordinarily comprise two or more pairs of hard rollers. The witness Squier said that they resemble a laundry wringer, except that the rolls are sometimes two feet in diameter and six feet long (App. 13). One of these rolls is heated. Ford and Hall say "We prefer to operate the heated roll of the glazer at a temperature from about 300° F. to about 400° F., desirably at 350° F." The purpose of this heating is to ensure the performance of a reaction not only between the starch and the aldehyde, but also between the free aldehyde and the cellulose. This is quite clearly explained in the Ford and Hall application (App. 66, last paragraph). The mechanism of this reaction is explained by Dr. Nickerson, in general at App. 22, 4th and 5th questions, and in greater detail at App. 31-32. Nickerson discussed this reaction in several other places, specifically at App. 24, where he explained not only that the claim required the presence of an aldehyde as such but also explained the function which that aldehyde performed.

It is important to note that there are *two* reactions contemplated in the Ford and Hall process. One of these is reaction with the starch. This reaction may take place entirely on the calender, as pointed out in the Ford and Hall specification at App. 71, in the last paragraph. The inventors prefer, however, to *semi*-react the aldehyde and starch before applying them to the fabric, leaving unreacted or free aldehyde for the second reaction. The second reaction is the reaction which takes place between free aldehyde and cellulose when curing temperatures are applied. "Methylated cellulose" as the patent application puts it (at App. 66, line 6 from the bottom), "is formed during the curing." Temperatures required to effect this reaction are in excess of 280° F. Where the degree of heat applied in the calendering step is insufficient to ensure completion of the aldehyde-cellulose reaction, it may be desirable to after-cure the fabric in an oven (App. 67).

It is abundantly clear that the application describes a process in which a textile fabric is sized with a water solution containing a polysaccharide carbohydrate and with an aldehyde. It is clear that this recitation refers to the presence of aldehyde *as such,* i.e., free aldehyde, in the fabric. It is also and equally clear that that aldehyde subsequently plays an important part in making the mechanical finish durable.

As to the assertion that Plaintiffs' technique "is such as flows from the natural development of the art by one skilled in the field, and is not invention", attention is directed to Dr. Nickerson's testimony at App. 23, beginning twelve lines from the bottom, and continuing to line 4 of App. 24. Dr. Nickerson's qualifications are given at App. 14-15. He testified in effect that it was surprising and unexpected to him that Plaintiffs' process would produce the result described and claimed. Squier (App. 53) establishes that the process will in fact do what is claimed for it.

That this process is adequately and accurately defined in Claim 22 has been fully demonstrated in the analysis of that claim appearing at Pages 4-5 hereof. Every feature of the process recited in Claim 22 is incorporated by reference in each of the remaining claims, including the presence of aldehydre as such (App. 24). If Claim 22 is patentable over the art, then all the rest, being more limited than 22, are patentable too.

THE CLAIMS IN SUIT.

Claim 22 has been analyzed in detail at Pages 4-5 hereof. It will be remembered that this claim calls for the production of a durable lustrous mechanical effect; that it requires that a cellulosic fabric be sized with a water solution containing a polysaccharide carbohydrate and with free aldehyde; that it specifies drying to dampness, imparting a mechanical effect by a pressure mechanical finishing machine, and curing at temperatures from 280° F. to 400° F. This is the limit and extent of the general process fully and adequately disclosed in the Ford and Hall application as filed.

Various features are of especial advantage. These are presented in the form of dependent claims. Each of them incorporates by reference all of the recitations of the primary claim upon which it is dependent. Thus Claim 23 is particularly directed to the process recited in Claim 22 characterized is that the curing *follows* the application of the mechanical finish. This technique would be employed, as disclosed in the Ford and Hall specification (at App. 67, third paragraph from the bottom of the page) where a beetling machine is used. The beetling process is carried out without added heat, and for this reason, it is important to after-cure the mechanically finished fabric.

Under appropriate conditions, particularly in friction glazing, the fabric is passed two or three times through the glazer. Under such circumstances, all of the heat necessary to ensure complete curing may be applied during the glazing process (App. 67, first paragraph). Claim 24 is specific to this feature.

Ford and Hall point out (at App. 66) that it is desirable, for practical considerations to add "excess" aldehyde. They say (at App. 68) that this refers to aldehyde in excess of the theoretical amount required to react with the carbohydrate. The addition of aldehyde over and above that theoretically needed to react with cabohydrate is covered in

Claim 25. It should be borne in mind, in this connection, that even where the amount of aldehyde used is only that which would be theoretically required to react with the aldehyde, there will always be free aldehyde present when the process is carried out according to the Ford and Hall instructions (App. 21-22).

Ford and Hall explain, in the paragraph bridging App. 69-70, that it is sometimes desirable to *semi*-react the solution as when a thick boiling starch is used. They explain (in paragraph starting at the last line of App. 65 and continuing on App. 66) that the heat employed in semi-reaction must be kept below 212° F. "in order to avoid objectionable loss of aldehyde". This feature is incorporated in Claim 26, which calls for preliminarily reacting at temperatures from 190° F. to just short of 212° F.

Ford and Hall expressly state (at App. 67) that they prefer to operate the heated roll of the glazer at a temperature from about 300° F. to about 400° F., desirably at 350° F. This preferred temperature (350° F.) is recited in Claim 27.

The speed of the reaction, as Ford and Hall point out (at App. 65) may be increased by the presence of a catalyst, although this catalyst should not be so acid as to produce a pH value below 4. Otherwise, "excessive undesirable tendering takes place". "At higher values", they say, "the curing becomes excessively slow". These features are recited in Claim 28.

Claim 29 is specific to the use of formaldehyde, which is applicants' preferred material for most uses.

Claim 30 specifically identifies the preferred catalyst, namely, ammonium thiocyanate.

Claim 31 is directed to the production of chintz finishes, namely, those in which the mechanical finish is imparted by *friction* glazing. Such fabrics have a high luster.

The derHorst Reference.

(U. S. Patent 2,099,765. App. 87-96.)

In rejecting the claims, the Patent Office held that derHorst applied substantially the same material to fabric as did Ford and Hall. This same error was followed by the Court below. Let us therefore take a look at the disclosure of the Horst, et al., patent.

Stripping the case of as many complications as possible, it is believed fair to say that derHorst was concerned with only one problem, namely, reducing the solubility of ordinary starch. The use of starch to coat the surface of a fabric and to stiffen it has been known almost from antiquity. But, on a starched shirt, as everybody knows, the starch is removed entirely when the shirt is washed. The wash water dissolves some of the starch, and the action of the water and the washing will physically remove the remainder.

derHorst proposes to reduce the solubility of ordinary starch by reacting starch with an aldehyde. This reaction will begin when starch and aldehyde are brought together, even at room temperature. But it is important to derHorst that the reaction should not proceed to such a point that the starch becomes completely insoluble in water. This is because it is necessary, in order to use starch effectively, that it be applied in a water solution or dispersion (App. 27, last paragraph). Consequently, derHorst repeatedly asserts that the aldehyde and starch reaction product must be in a form "still capable of yielding a paste." derHorst mentions pasting no less than eleven times in his brief specification, and includes the recitation "capable of yielding a paste" (or its equivalent) in every one of his claims. He says: "The period of the interaction of formaldehyde and starch depends on the special kind of starch used; it is so selected that the starch is still capable of yielding a paste *after* the said interaction is *completed*". (Italics added.) (App. 88, lines 14-16.) He makes quite certain that the reaction will not go beyond this point, either (a) by physically removing free aldehyde when the desired degree of reaction has been attained, or (b) by utilizing so small a proportion of aldehyde with reference to the amount of starch present that all of the aldehyde will surely be used up in the aldehyde-starch reaction before the insoluble state has been reached (App. 42-43).

Thus, in Example 1, after the starch and aldehyde solution have been reacted for seven days, he dries the reaction product at 45° C. in vacuo. This will effectively remove any unreacted, i.e., free aldehyde which might happen to be present at that time (Nickerson—App. 42). The obvious reason for removing the aldehyde is that starch preparations are frequently made up in batches long before they are used. If derHorst permitted any free aldehyde to remain in the starch preparation, he would be quite likely to find the entire batch insoluble when the time came to use it (App. 27, last paragraph). It is believed to be quite apparent that the presence of free aldehyde in the treated starch would be detrimental to the basic concept of derHorst.

Dr. Nickerson testified on direct examination (App. 29): "Q. Does derHorst teach a process or disclose a process in which there is free formaldehyde in the solution at the time the solution is applied to the fabric? A. No; at least there is very little free formaldehyde present in those solutions. Q. Is there a sufficient amount of free formaldehyde present for purposes of reaction? A. In my opinion, there is not. Q. Would you call the solution as disclosed in the derHorst patent a free formaldehyde solution? A. No, sir, I would not any more than I would call ordinary drinking water which has been treated with chlorine for purposes of purification a solution of chlorine."

This testimony stands unrebutted, and reaffirmed on cross-examination (App. 42-43). Since there is no aldehyde left in derHorst's treated fabric to react with cellulose, the second, or aldehyde: cellulose reaction, which plaintiffs' process requires cannot take place in a fabric treated according to derHorst (App. 32).

derHorst does not impart, nor suggest the imparting of a mechanical effect to the fabric which he treats. He does not use a pressure mechanical finishing machine. The Board of Appeals so held, in italics (App. 86). This point has also been amplified in the examination of Squier. derHorst mentions almost no mechanical agencies. He speaks of ironing. Squier testified that the pressures exerted with an iron would be "pressures of five or maybe at the very utmost ten pounds per square inch;" that such pressures would not deform the fibers; and that "you could not secure a pressure mechanical finish in that way" (App. 54). derHorst speaks of a Foulard machine. That is a machine for "fluffing up" fabrics. It operates on fabric which is in a tankful of water, i.e., "in the wet state" (Squier—App. 53, last paragraph). derHorst also mentions a Rackel machine. That is a machine for applying a size to a fabric. It also operates "in the wet state," and is not a finishing machine at all. The only other treatment mentioned by derHorst is the drying. In one place (App. 93) he mentions passing the fabric through a "so-called Foulard finishing machine" and leading it four times over drying cylinders heated by means of steam having a pressure of two atmospheres. Steam at thirty pounds pressure (about two atmospheres) has a temperature of 250° F. This is thirty degrees *below* the *lowest* temperature to which the aldehyde cellulose reaction will occur. The drying cylinders referred to are very familiar tools of the textile trade. They exert no pressure whatsoever on the fabric. It would be silly to Foulard a fabric, so as to fluff it up, and then subject it to pressure to mat it down.

It is believed to have been shown that a material which has been sized with the aldehyde starch of the derHorst patent does not contain free aldehyde; that derHorst does not teach or suggest the application of a mechanical finish, nor the application of temperatures at which Plaintiffs' aldehyde-cellulose reaction will occur. The Court was plainly in error in saying that: "The chemical compounds used in Plaintiffs' process are clearly the same as those used in the Horst, et al., patent," for the sized fabric of derHorst does not contain free aldehyde. The Court was plainly in error in saying that "The method of application and finishing is anticipated by both the Horst, et al., patent and the Lippert patent."

The Lippert Reference.

(U. S. Patent 2,148,316. App. 96-101.)

Now let us analyze the Lippert patent.

In the prosecution of plaintiffs' application before the Patent Office, the Board of Appeals expressly held that it relied upon Lippert as showing the application of a pressure mechanical finish. Nothing in the prosecution of the case even suggested that Lippert was regarded as disclosing the sizing of a fabric with a polysaccharide carbohydrate and an aldehyde. Lippert does not in fact disclose this, for reasons to be explained hereafter.

But it has been admitted from the start that the *physical* steps of applying a liquid to fabric, drying it to dampness, passing it through a mechanical finishing machine and heating it are individually and collectively old in the art. Since these were the only steps which the Patent Office had apparently relied upon Lippert as disclosing, there seemed to be no point in encumbering the record with an extensive exploration of the Lippert disclosure. For this reason, Plaintiffs conceded at the trial of this case that these physical steps were known, and offered no testimony with reference to Lippert.

In his argument at the trial, however, Counsel for the Defendant asserted that he believed that Lippert *alone* "came into the picture" with respect not only to Claim 30, but also with respect to all the other claims (App. 57). For this reason, we believe it necessary to offer a few comments on the Lippert patent.

Lippert proposes to make a lustrous mechanical finish durable to washing, but his technique for doing so is fundamentally different from that of Ford and Hall, in a basic chemical sense.

Lippert says that he uses "the resin, urea-formaldehyde". It has been noted above that "the resin, urea-formaldehyde" is a definite chemical *compound,* and not a mere mixture of urea and aldehyde. It does not contain free aldehyde, any more than salt contains free chlorine. Lippert impregnates a fabric with a solution containing this resin. As is fully explained in the Hall affidavit (App. 72—paragraph 4), the resin must be employed in an initial state of polymerization not beyond the A-stage. Urea-formaldehyde resin, in the A-stage, is composed of relatively quite small molecules. These molecules will penetrate into the fibers of which textile yarns are spun. When sufficient heat is applied to a urea-formaldehyde resin, a great number of small urea-formaldehyde molecules unite together to form a small number of quite large urea-formaldehyde molecules. Consequently, when curing temperatures are applied, as pointed out in the Hall affidavit, condensation of the resin takes place "on and *in* the fibers." The molecule "is made *so large* that it becomes water-insoluble." (Italics added.) This is in striking contrast to the theory of the present application. It is pointed out in the Hall affidavit at the top of Page 73 that the starch molecule *in its natural state* is of a size "so great that it can hardly be said to penetrate within a fiber." Dr. Hall's assertions as to Lippert deal with a patent owned by his employer, Joseph Bancroft & Sons Co., one of the plaintiffs herein. Dr. Nickerson, who has specialized in the chemistry of cellulose for many years, quite categorically stated that the molecule of starch would not penetrate the fiber. He said (App. 18) "The large molecular weight material—for example, starch—would be a coating in the sense that the molecules are too large to penetrate the fibers; hence starch is deposited on the surface of the fibers."

We have then a striking contrast in fundamental approach. The Lippert patent seeks to *infill* the individual fibers with unpolymerized resin, and then polymerize the resin "in situ" so that it is imprisoned *within* the fiber and physically occludes the entrance of moisture. In contrast, Ford and Hall apply a material which is already polymerized, with molecules too large to penetrate into the fiber, and which can therefore be held in place during laundering only by chemically bonding it to the surface of the fiber.

Lippert, like Ford and Hall, dries the fabric to dampness. But the 10% of moisture which Lippert retains in the fabric is not retained in order to plasticize the resin which he uses. That resin is a "thermosetting" resin. It is completely plastic right up until the time that it is set. Lippert retains 10% of moisture "to prevent too rapid polymerization" (Hall affidavit, App. 74, last two lines). Extensive polymerization prior to calendering would be harmful. The presence of moisture ensures that temperatures high enough to cause extensive polymerization will not be attained until the residual moisture is vaporized on the calender.

It will thus be seen that even in the physical aspects of the case, there is a substantial difference between Lippert and Ford and Hall, for the former intends to infill the fibers which he proposes to treat with unpolymerized material, while the latter use an already polymerized material having a molecular size so large that it will not penetrate the fiber. To this extent at least the Court below was clearly wrong in saying that "The method of *application* and finishing is anticipated by both the Horst, et al., patent and the *Lippert* patent." (Italics added.)

The Combined References.

It has been stated before, but should be stated again, that the combination of references which the Patent Office proposed has actually been made and tested. That "combination'' was the wholly volunteered suggestion that a durable, lustrous mechanical effect could ''obviously'' be produced by applying the derHorst material to fabric, and then using the physical steps of Lippert—i.e., drying to dampness, calendering and curing. This combination *will not produce* a *durable,* lustrous mechanical effect, as described and claimed in Plaintiffs' application. Instead, the lustrous finish washes off and is destroyed. (App. 46: ''Q. Has the glaze or lustre on Exhibit 6 been retained on Exhibit 4? A. No, definitely not.'') Four examples given in the derHorst patent were selected for purposes of test, these being Examples 5, 6, 9 and 11. They were selected because they were the only examples in the case which had been specifically mentioned by the patent office at any time during prosecution of the application.

Example 5 says that the starch was applied to collars and the collars were slung off and then ironed. Example 6 mentions the application of starch by means of a Rackel machine, followed by drying. Example 9 mentions passing the fabric through a Foulard finishing machine, and then drying over cylinders heated by steam having a pressure of two atmospheres. Steam at this pressure will have a temperature of about 250°, as mentioned heretofore. Example 11 was selected because it is the only example which uses an aldehyde other than formaldehyde. Exhibit P-6 shows the glazed fabric produced by applying the material specified in each of these four of the Examples of derHorst, and then proceeding according to Lippert. Exhibit P-4 shows that the specimens of Exhibit P-6 lose their glaze entirely when washed.

Furthermore, as has been pointed out before, there is no free aldehyde present in fabric which has been sized according to the teaching of the derHorst patent. No virtue is seen in repeating this argument, nor in once more explaining that ordinary ironing cannot possibly produce a mechanical finish; that a Rackel machine operates ''in the wet'' and cannot possibly apply a mechanical finish; that a

Foulard machine also operates in the wet and definitely does not apply a mechanical finish; or in pointing out once more that the quantity of paraformaldehyde used in Example 11 is so very small in proportion to the amount of starch present that there will not be any free aldehyde in that material. All of these assertions have been noted before, and record references to support them have been inserted in this brief.

It has been pointed out that for eminently practical reasons it is important to derHorst that the "aldehyde starch" which he uses (Fact Finding 3—App. 60) should *not* contain free aldehyde, because if it does it is likely to continue reacting beyond the point at which it is "still capable of yielding a paste". It is believed to have been fully demonstrated that a fabric which has been sized with the aldehyde starch of the derHorst patent will not contain any free aldehyde to react with the cellulose if it should subsequently be subjected to mechanical finishing and curing.

It has been pointed out that the step which Lippert uses, of drying the fabric to dampness (rather than completely dry) ensures against premature polymerization of the resin, and that, although the physical step of drying to dampness is identical in Plaintiffs' process, the residual moisture retained in Plaintiffs' fabric performs an entirely different purpose.

It has also been shown that the mechanism of the Lippert reaction is entirely different, in a chemical sense, from the mechanism of the Plaintiffs' reaction, for what Lippert seeks to do is to polymerize resin in situ *in* and on the fibers, whereas Plaintiffs propose to chemically bond starch which is *on but not in* the fibers to the cellulose of which the fiber is composed, using aldehyde as the chemical bonding agent and applying heat, *not* to polymerize the material (which is in a fully polymerized state before it even reaches the fabric), but to accomplish the desired aldehyde: cellulose reaction. It is believed to be clear that a complete understanding of the technique disclosed in the Lippert patent would make it seem quite illogical even to consider attempting to produce a durable lustrous mechanical finish by treating fabric with an already polymerized material such as starch or other polysaccharide carbohydrate.

The final and conclusive fact is that, logical or illogical, effecting the combination as proposed does not produce the desired result.

It is obviously improper to hold that a process is anticipated by or unpatentable over prior art references which do not severally disclose the process and which, even if combined, are incapable of attaining the objective which the process in issue achieves.

Authorities.

This case turns upon some cornerstone principles of patent law so well established that it is probably superfluous even to cite authority for them. It has been held in cases too numerous to mention that an assertion of lack of patentability over prior art requires a showing that the prior art produced "substantially the same result by substantially the same means."* We have nothing in this case to show that the use of Plaintiffs' means to produce Plaintiffs' result has ever even been contemplated by the prior art.

The Patent Office, guided by the disclosure in Plaintiffs' application, has selected from the prior art two fundamentally different textile treating processes, and has asserted that they can be combined without invention to produce the result described and claimed herein. This is a clear illustration of the exercise of what has been referred to as "the *ex post facto* wisdom of the bystander"—which the Seventh Circuit Court of Appeals held that Judges should not "too readily accept." *Railway Supply Co. v. Hart Steel Co.*, 222 Fed. 261, at Page 273. The soundness of this warning against such "ex post facto wisdom" is strikingly demonstrated in the present case, for when that "wisdom" is followed, and the two prior processes are in fact combined, the lustrous finish obtained is not durable, but washes off. In other words, the combination of the two is inoperative to realize Plaintiffs' objective.

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* Walker on Patents—Deller Edition, Vol. I, Pg. 255:

"Therefore in order to negative novelty or, as it is usually expressed, to 'anticipate' an invention, it is necessary that all of the elements of the invention or their equivalents be found in one single description or structure where they do substantially the same work in substantially the same way." (Authorities cited)

Many authorities having to do with asserted lack of invention in situations of this type are collected and discused in an opinion handed down by the District Court for the District of Connecticut in the case of *United Chromium Inc. v. International Silver Co.*, 53 Fed. 2nd 390. The Court's attention is respectfully directed to this opinion, for the reason that it so ably presents the state of the law on this topic.

As Justice Holmes said, in reference to chemistry, "There is no 'of course' as to what nature can do, except as proved by observation and experiment"—*Minerals Separation, etc. v. Magma Copper,* 280 U. S. 400; 50 S. Ct. 185; 74 L. Ed. 511.

For other cases to the same tenor, see:

> *Diamond Rubber Co. v. Consolidated Tire Co.,* 220 U. S. 428, at Page 435, 55 L. Ed. 527; 31 S. Ct. 444;
>
> *Corona Cord Tire Co. v. Dovan Chemical Corporation,* 276 U. S. 358, at Pages 368, 369; 48 S. Ct. 380, at Pages 382, 383; 73 L. Ed. 610;
>
> *Carnegie Steel Co. v. Cambria Iron Co.,* 185 U. S. 403, 22 S. Ct. 698, at 707, 46 L. Ed. 968.

The Court of Appeals for the Second Circuit, speaking through Judge Shipman, said of a pair of alleged prior inventors:

> "They were perhaps among the prophets; but it requires more than prophecy of what may be done or than declarations of what ought to be accomplished, to make a good patent reference, not to speak of an anticipation. It is necessary to show with reasonable certainty how the desired result can be accomplished." *Westinghouse, etc., Co. v. Great Northern Co.,* 88 Fed. 258.

In the present case, we do not even have a prophecy. The suggestion that derHorst and Lippert might be combined was wholly volunteered by the Patent Office, and when it is followed, only frustration ensues.

The Ellis Text.

During the trial of the case, Defendant's Counsel offered in evidence certain pages from a text book entitled: "The Chemistry of Synthetic Resins", by Carleton Ellis. These pages are reprinted at App. 101-104. It is respectfully submitted that this text, which was introduced without notice to Plaintiffs' Counsel in advance of trial, contains nothing of any real importance to the issues of the present suit. From the questions asked in cross-examination of Dr. Nickerson, and also from the very fact that the Ellis text was offered, it seems logical to assume that the Solicitor for the Commissioner of Patents must have been under the mistaken impression that the Lippert process involves the application to fabric of a material which contains free aldehyde. This is not the case. Lippert says that he applies "the resin, urea-formaldehyde" and that is a definite chemical compound—not a random mixture. If Counsel for the Commissioner of Patents had not been laboring under this misapprehension, it is difficult to understand why he inquired about the presence of ethyl cellulose in the Lippert formulation. Ethyl cellulose might be regarded as a polysaccharide carbohydrate (Nickerson—App. 40, second and third questions). Lippert uses a small amount of ethyl cellulose as a softener. But the resin which Lippert applies to the fabric does not contain free aldehyde.

Some questions were asked, at App. 38-39, from which it might be supposed that the Ellis text was believed relevant because of its teaching that ammonium thiocyanate (which is the preferred catalyst used in the Lippert patent and also in the process in suit) would react with formaldehyde in the solution to produce a resinous product, presumably analogous to that which Lippert employs. This Dr. Nickerson categorically denied (App. 38). The relevance of the point is obscure. The claims in issue have to do with reactions between polysaccharide carbohydrates, free aldehyde, and cellulose. No claim is made to the reaction product of ammonium thiocyanate and aldehyde, so that the question of whether such a product would be resinous or not seems quite irrelevant, especially in view of the fact that Nickerson has quite bluntly asserted that such a product would not be formed under the conditions stated in the Ford et al., application.

The text book can scarcely be regarded as rebutting this assertion. The text says that it is possible to form a resinous reaction product from ammonium thiocyanate and formaldehyde by employing concentrated materials in molar proportions. It is respectfully suggested that the subject matter of the text book reference is wholly immaterial to the issues of the present case.

CONCLUSION.

The record in this case demonstrates conclusively that the prior art references, neither separately nor in combination, produce the result described and claimed. They can not, even when modified by the gratuitous suggestion of the Patent Office, accomplish "substantially the same result by substantially the same means." If ever there was a case which clearly demonstrated the wisdom of the basic rules referred to just above, this case is that one.

The Judgment of the Lower Court should be set aside, and the case remanded with instructions to enter a decree for Plaintiffs, as prayed for in the complaint.

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Reply Brief for Appellants.

IN THE

United States Court of Appeals

DISTRICT OF COLUMBIA.

District of [illegible] Circuit

No. 10,905.

FLORENCE M. FORD,
ANNE E. HALL, Executrix of the Estate of WILLIAM P. HALL, Deceased, and JOSEPH BANCROFT & SONS CO.,
Appellants,

v.

JOHN A. MARZALL, Commissioner of Patents,
Appellee.

On Appeal from a Judgment of the United States District Court for the District of Columbia Dismissing the Complaint in a Suit to Obtain a Patent.

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APPELLANTS' REPLY BRIEF.

As we read appellee's brief, it would appear that the issues may well have been simplified. It will be recalled that the claims in suit were refused by the Patent Examiners and the Board of Appeals as unpatentable over a combination of two references.

Appellee's brief (p. 6) opens its argument on the merits with this paragraph:

> "Since all the claims sought have been refused on the same references or combination of references, all the claims may be considered as a unit. If this *combination* of references is proper, all the claims are unpatentable; *if the combination is not proper, then, as appellants point out* (Br. 13) *all the claims are patentable.*" (Italics added.)

It seems unlikely that such a concession would have been made if counsel for the appellee really had any confidence in the proposition (argued elsewhere) that either reference alone would support rejection of the claims. Obviously, if either reference alone were sufficient, the rejection would be sound, whether or not the combination was proper. We therefore focus our attention on the real question—whether the proposed combination affords a proper basis for the rejection.

In determining patentability, it is not proper to combine references, generally speaking, unless it would be obvious to one skilled in the art that the combination should be made. It is not proper to refuse claims on a combination of references when these references, when combined, are inoperative to produce the result described and claimed. Moreover, it is not proper to combine references, even if it be assumed that the same result is attained, unless that result is attained by "substantially the same means".

Here the rejection of the claims on the combination of references proposed by the Patent Office is not proper, for all three reasons.

(A) It is obvious to one *skilled* in the art that the references should *not* be combined. Dr. Ralph Nickerson of Monsanto Chemical Company, a qualified expert, so testified.[1] There is no *evidence* to the contrary in the record of this case.

(B) If they are combined, they are inoperative to produce the same result. The objective of the invention is to secure a lustrous finish, which is *durable* to washing. The lustrous finish produced when the processes of the two references relied on are combined as suggested by the Patent Office is *not* durable to washing. It washes out. That is the *unrebutted* testimony in this case (App. p. 52): "Q. Has the glaze on Exhibit 6 been retained on Exhibit 4? A. No. Definitely not."

Examination of the two physical Exhibits, 4 and 6, referred to, makes it very plain that this answer is correct. Exhibit 6 is a group of specimens treated according to various examples of the der Horst patent and then subjected to a hot-calendering treatment as taught by Lippert, but before washing. Exhibit 4 shows samples of the same specimens as Exhibit 6, but after washing. The lustrous finish has been effectively lost.

(C) The combined references fail to produce the desired result because they do *not* employ substantially the same means.

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[1] Nickerson, App. 30: "Q. In other words, if I understand you correctly, if you treated the textile fabric with the process disclosed in der Horst, and then you dried that fabric to dampness, pressure mechanically finished it, and cured it within the temperatures set forth in the Ford and Hall application, you would not obtain a durable mechanical finish; is that right? A. In my opinion, you would not." See also, Hall affidavit, App. 74.

The "means" by which appellants' invention attains an unexpected and surprising[2] result is made very clear in the patent application: in addition to the starch, there must be present, aldehyde, as such, in the fabric when it enters the calender, so that this free aldehyde may effect, on heating, "a substantial but not excessive reaction with the cellulose" (App. 67).

There is no aldehyde present, as such, to accomplish this reaction in the process of der Horst. All the aldehyde in his process has either been used up in reacting with the starch, or else has been driven off (formaldehyde is a gas) by drying in the warm, preferably under vacuum, as der Horst teaches (App. 42-43).

Consequently, it makes no difference what kind of calendering or curing steps might be applied to fabric which had been treated according to der Horst's teaching, for der Horst's process removes the vital ingredient—the aldehyde—either by reacting all of it, or by reacting some and then driving off the rest. There is nothing left which can chemically react with the cellulose (i.e., the fabric itself), no matter how much heat is supplied, and consequently there is no possible way to make the calendar finish durable to washing, assuming arguendo, that it would seem "obvious" to apply such a finish to der Horst's fabric.

The basic difficulty with the attempted combination is this—namely, that der Horst completely lacks the reagent necessary to produce the desired and claimed result, i.e., the presence of free aldehyde after sizing and drying, to react with the cellulose. Since this is missing, it makes no difference what reference is used to show the other steps. It is for this reason that any attempted combination is inoperative to produce the desired result. It is for this reason that whatever the result be that is obtained, it is not obtained by the same means.

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[2] Nickerson, App. 23: "A. I would not have expected that result"; App. 24: ". . . I would have been surprised, or would not have expected you could do it that way".

This controlling factor seems to have completely escaped the Patent Office, possibly because it did not have the testimony of witnesses to emphasize it. But it is fully developed in the evidence adduced at trial, and the evidence stands unrebutted.

* * *

Since it is plain that the suggested combination of references is not only one which those skilled in the art would repudiate, but also is one which lacks the means to produce the result set forth in the claims in issue, and therefore fails to produce that result, we might rest here, relying on the statement at Appellee's brief, page 6, that if the combination is not proper, all of the claims are patentable.

However, there is an apparent inconsistency in appellee's brief, for notwithstanding this concession, it is argued not only that the combination is proper, but also that the claims are not patentable over either of the references separately. In view of the concession that all of the claims are patentable if the combination of references is not proper, it seems clear that even appellee's counsel can scarcely place much reliance on the contention that either reference alone will suffice. Nonetheless, since these contentions can be readily disposed of, a brief comment with reference to each point is here appended.

Lippert does not teach a process in which there is any aldehyde, as such, in the fabric as it enters the calender. Lippert uses "*the* particular *resin,* ureaformaldehyde" (App. 98), and that is an article of commerce, produced by the reaction of urea and formaldehyde but containing neither material as such (cf. the compound sodium chloride, which "contains" neither sodium nor chlorine, as such). The Lippert patent, consequently, does not apply "an aldehyde" to the fabric. Therefore, Lippert fails to meet the claims (all of which require that the fabric be sized with "an aldehyde") as both the Patent Office Examiner and the Board of Appeals obviously realized.

Der Horst (which, as we have shown, leaves no free aldehyde to react with the cellulose), does not contemplate the application of a pressure mechanical finish. The Board of Appeals stated in italics (App. 86) that ". . . der Horst was *not* considered as disclosing a *pressure* mechanical finishing machine". (Emphasis quoted.) See also, App. 33, 44 and 54 for appellants' unrebutted testimony on this point.

Since there is in der Horst no aldehyde present to react with the cellulose of the fabric, and he does *not* contemplate the application of a pressure mechanical finish, it is not accurate to say that "he processes the sized material in substantially the same way". He does *not* do so, either in a physical sense or in a chemical sense.

Appellee assumes that, if Claim 22 is held unpatentable, all of the remaining claims must also fall, because the limitations which they add to Claim 22 are found in one or another of the two references relied on. This is by no means conceded by appellants.

Consider Claim 25: It calls for using an excess of aldehyde over the amount required to react with the carbohydrate. "Excess" as used in chemistry and in the application in suit means "over and above the amount theoretically needed." As Nickerson testified (App. 21-22) there will always be free aldehyde in appellants' process to react with the cellulose on calendering, even where the amount used is only that which is theoretically necessary, because the three hydroxyl groups on each cluster (or "bead") of the starch molecule differ in their affinity for aldehyde. Consequently, if the amount of aldehyde is great enough to meet theoretical requirements, the reaction between aldehyde and starch in appellants' process will never go to completion. There will always be free aldehyde left to react with the cellulose during calendering and curing. But in der Horst's process, he uses so little aldehyde in proportion to the starch in some examples that the reaction uses up all of the aldehyde, and in the other examples he physically removes any aldehyde not yet reacted, as by vacuum drying in the warm. This is *necessarily* correct. der Horst's process *stops* after the sized fabric is dried. It would be unthinkable to permit free aldehyde (which has a vile odor) to remain in the final product of der Horst. Consequently, no matter what conclusion is reached with reference to Claim 22, Claim 25, which calls for *excess* aldehyde, is clearly patentable.

Or consider Claim 28, wherein the use of a catalyst is specified, and its selection is correlated to the pH value to be produced upon the fabric. There is not a single word about pH in either of the patents relied upon. Nor does der Horst even mention the word "catalyst". He uses acid, not as a catalyst, but as a dispersing agent, "by means of" which his starch-aldehyde preparation is "pasted" with water. "Pasting" is the conversion of a lumpy mixture of starch and water into a smooth, homogeneous dispersion. The whole idea of an aldehyde-*cellulose* reaction is lacking from der Horst, and consequently he neither wants a catalyst, nor suggests any advantage in using one which will establish a pH above 4. Since Lippert does not apply "an aldehyde" to the fabric, his teachings as to catalysts are quite irrelevant to the problem. What Lippert wanted to catalyze was the polymerization of the urea-formaldehyde resin. There is no material in appellants' process which is capable of polymerization. Starch is a fully-polymerized material in its natural state (Hall Affidavit, App. 73).

Similar observations apply to other specific features of improvement recited in other claims, for which see our main brief, pages 14-15.

As to appellee's criticism of appellants' tests, appellants offered no tests to show that their process was operative *without* a catalyst because that question had never been raised. There is absolutely *nothing* in the record of this case to justify raising it now. The tests reported at App. 46-57 give *comparative* results. Since der Horst incorporates "acids or acid reacting compounds" in all four of the examples under scrutiny, and since appellants' application calls for the inclusion of an acid-reacting catalyst in all of the examples selected as being nearest to those given by der Horst, it was obviously *necessary* to include the acidic agent in both sets of tests if they were to be truly comparative. That is what was done, and the result shows that, even with an acidic agent present, a lustrous hot-calender finish applied to fabric treated with the compositions of der Horst is not durable to washing, whereas the finish produced under parallel conditions, so far as possible, but according to appellants' teaching, is durable.

An effort is made in appellee's brief to belittle the difference between ordinary ironing (which appellee chooses to describe as a mechanical finishing operation) and *pressure* mechanical finishing. There is abundant and categorical testimony in the record to show that these processes differ in kind—5 to 10 pounds per square inch in ironing, 1000 pounds per square inch in calendering (App. 54).

Calender pressures are necessarily extreme, because they must "deform" the fibers of which the yarns which make the fabric are composed (Squier, App. 12-13). Ironing will not do this (Nickerson, App. 44; Squier, App. 54). The reason for emphasis on this difference may not be entirely clear to those not conversant with ordinary textile finishing procedures. The point is that in a fabric which has merely been ironed, the fibers remain in a relaxed state. Even if they are moistened and swell up, they continue to occupy the same relative positions, so that a relatively insoluble sizing coat, ironed into the fabric, is not dislodged or broken up. But in calendered fabric the deformed and compressed fibers are in a state of extreme internal stress, roughly proportional to the quantum of force needed to deform them in the first place, and as soon as moisture reaches them they not only swell up, they spring back into their undeformed positions with tremendous force, and will break up and dislodge any sizing coating not chemically bonded to them.

The insolubilized sizing which appellants' process yields is *not* dislodged by washing because the aldehyde has reacted with the *cellulose* during curing [3] to produce a chemical combination not affected by water. The insolubilized sizing of the der Horst patent *is* dislodged because, even if it is mechanically finished and *cured* (as der Horst does *not* suggest), there is no aldehyde present at the time of curing and consequently the all-important aldehyde reaction with the *cellulose* cannot take place.

SUMMARY.

1. The number of authorities dealing with the propriety of combining references is legion. We know of no case which supports the propriety of a rejection of this sort where all three of the elements listed, ante, are lacking—where the really skilled operator would know in advance that the combination won't work; where actual test demonstrates that it is inoperative to give the desired result; and where the vital means—an aldehyde present in the fabric when it reaches the calender and free to react with the cellulose—is lacking in *both* patents.

2. There is absolutely nothing in the record of this case to justify an assumption that appellants' process will not operate without a catalyst. A catalyst, by definition, is a

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[3] Every claim requires curing within the range 280°F.-400°F. because such temperatures are needed to effect the aldehyde-cellulose reaction. (App. 25).

material which will "*accelerate*" a reaction. Once again we return to the proposition that if appellee seriously entertained a genuine doubt as to the operability of the process, it was incumbent upon appellee at least to make a prima facie showing in support of its contention. This has not been done. At the very least, appellee's Counsel should have voiced his objections at the time the tests were made, for they were conducted in his presence, prior to trial (App. 47).

3. Appellee suggests that the difference in result, as between the suggested combination of references and the result produced by appellants' process, is no more than a matter of degree. The difference between that which succeeds and that which fails is never just a matter of degree. Exhibit 4 demonstrates that the combination of references proposed does not produce a lustrous mechanical finish which is durable to washing. Exhibit 5 conclusively shows that the process of the present application produces precisely that.

Respectfully submitted,

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